RESPONSE ACTION CONTRACT
FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND NON-TIME CRITICAL REMOVAL ACTIVITIES
AT SITES OF RELEASE OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES IN
EPA REGION VIII

PHASE I SAMPLING AND ANALYSIS PLAN FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY OF BAYOU VERDINE AREA OF CONCERN CALCASIEU ESTUARY COOPERATIVE SITE LAKE CHARLES, LOUISIANA

OCTOBER 1999

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Work Assignment No.: 041-RICO-06FY

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EXECUTIVE SUMMARY

CDM Federal Programs Corporation (CDM Federal) is conducting a multi-media site characterization of Bayou Verdine within the Calcasieu Estuary, Calcasieu Parish, Louisiana (Figures 1-1 and 1-2). The characterization is part of a remedial investigation/feasibility study (RI/FS) for the U.S. Environmental Protection Agency (EPA) Region VI under the EPA Region VIII Response Action Contract (RAC) No. 68-W5-0022, Work Assignment No. 041RI-CO-06FY. The RI/FS involves the investigation and characterization of organic and inorganic chemical contamination, as well as assessment of human health and ecological risk and alternatives to mitigate unacceptable levels of environmental contaminants within Bayou Verdine. Chemical contamination, primarily from local industrial activities, has been detected in the surface water, sediment, fish, and crustacea in the Bayou Verdine Area of Concern (AOC).

This Sampling and Analysis Plan (SAP) describes the proposed field investigation and analytical protocol for Phase I of the RI. The development and focus of the proposed characterization program, described herein, have been cooperative efforts among EPA, Louisiana Department of Environmental Quality (LDEQ), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (FWS), and CDM Federal. This SAP conforms EPA guidance for site characterization and quality assurance.

The SAP is organized as follows:

SAP Part II: Quality Assurance Project Plan

Section 5 - Project Management
Section 6 - Measurement and Data Acquisition
Section 7 - Assessment and Oversight
Section 8 - Data Validation and Usability
Section 9 - References

Appendix A - Systematic-Random Sampling Strategy
Appendix B - Health and Safety Plan
Appendix C - Standard Operating Procedures
Appendix D - Specialized Sampling Equipment
Appendix E - Field Forms
Appendix F - Contract Laboratory Program Protocols

The objectives described below are based on EPA's SOW and a review of existing hydrogeologic and geochemical data collected during previous studies within the AOC. The specific Phase I objectives include:

- Develop data quality objectives and an analytical protocol that will allow characterization of the nature and extent of contamination within sediment and surface water, support feasibility study data needs, and support human health and ecological risk assessment data needs;

- Develop sampling protocols to characterize the nature and extent of organic and inorganic contamination in sediment and surface water within the Bayou Verdine AOC; and

- Collect data to support an evaluation of whether further action (or no further action) is required for the sediment and other potentially-impacted media within the Bayou Verdine AOC.

Bayou Verdine is a wetland bayou that flows through or adjacent to property owned by Vista Chemical Corporation (Vista), Conoco, Inc. Lake Charles Refinery (Conoco), and Pittsburgh Paint and Glass Industries, Inc. (PPG). These facilities are all active. Previous investigations indicate that surface water and sediment in the Bayou Verdine AOC are mostly contaminated by volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, total petroleum hydrocarbons (TPHs), and various inorganic elements (i.e., heavy metals) from industrial discharges and releases. Although organic and inorganic contaminants have been detected during environmental studies dating back to the early 1970s, the Bayou Verdine AOC has not been proposed for inclusion on the National Priorities List (NPL).

The land around Bayou Verdine includes undeveloped, rural residential, commercial, and heavy industrial property. No residents inhabit the site, but up to 27,000 people live within four miles of the site (PRC 1994). Neighboring populations include a number of residences within 200 feet of the bayou near New Trousdale Road and the Mossville School that is within 1,000 feet of the bayou (Figure 2-1). Although Bayou Verdine is not used as a drinking water source, the estuary surface waters have been designated by LDEQ as supporting primary contact recreation, secondary contact recreation, and fish and wildlife propagation (PRC 1994). Bayou Verdine supports limited recreational fishing and has several delineated wetlands. Health advisories warning of contaminated fish consumption have been issued for the Calcasieu Estuary, including Bayou Verdine (LDEQ 1999).

The Phase I sampling is designed to support risk characterization and determination of the nature and extent of organic and inorganic contamination within the Bayou Verdine AOC. Proposed Phase II and III sampling, not discussed herein, will address data gaps (e.g., areas with high error variance), hot spot delineation (i.e., refining the extent of contamination within the AOC), tissue sampling, and contaminant gradients within the sediment and surface water for ecological risk considerations.

The number of environmental characterization samples proposed for collection within the AOC considers the following: (1) the limits of the AOC, (2) the varying physical features (including land use, inputs, etc.) of the bayou, (3) the location and concentration of historical data, and (4) EPA’s Fully-Integrated Environmental Location Decision Support (FIELDS) software.

The proposed sampling program is a systematic-random design, which is a compromise between the data needs for characterizing nature and extent (i.e., systematic design needs) and evaluating potential risks (i.e., random design needs). The melded systematic-random program establishes a number of equal area grid cells along the AOC using FIELDS in which the specific node to be sampled is randomized by a randomly-selected staring point.

Proposed sediment samples include 50 “random” surface sediment characterization samples collected from the 0 to 15-centimeter (cm)(0 to 6-inch [in]) depth interval, 20 multi-depth sediment “vertical profile” samples collected from two discrete depth intervals (i.e., 15 to 30-cm [6 to 12-in] and 30 to 45-cm [12 to 18-in] depth intervals) at 10 of the 50 above-referenced surface sediment sampling locations, and seven quality control samples. Sediment samples will be collected from the thickest sequence of sediment at each location using a decontaminated petite Ponar®, modified Ekman® dredge, or dedicated aluminum push tubes. Sampling locations will be accessed by boat.

Proposed surface water samples include 12 deep surface water characterization samples collected from the bottom one-third of the water column, 12 shallow surface water characterization samples collected from the upper one-third of the water column, and four quality control samples. Surface water samples will be collected using a decontaminated Kemmerer® water sampler, a Van Dorn® bottle, and/or a peristaltic pump with dedicated tubing. Samples will be collected from downstream to upstream and surface water samples will be collected first at each location to minimize the potential for cross-contamination of samples. All sampling and analysis efforts will be conducted in accordance with CDM Federal standard operating procedures (SOPs) and EPA’s Contract Laboratory Program (CLP) requirements.

Investigation-derived waste (IDW) will consist of only aqueous waste (i.e., decontamination and rinse water). The wastes will be stored in appropriate containers (55-gallon drums), on appropriate containment, in a secured area.

All samples will be analyzed offsite. Three potential analytical laboratories will be used including a subcontract laboratory, EPA's Regional (Region VI) Laboratory, and EPA's CLP. The analytical protocol includes target analyte list (TAL) metals, VOCs, SVOCs, pesticides, herbicides, PCBs, and dioxins/furans. Dioxins/furans analyses will be limited to 20 percent of the samples. Analytical protocols include EPA SW-846 (EPA 1997) and EPA CLP standard methods. In addition, 20 percent of the samples may also be analyzed for ancillary parameters including total organic carbon (TOC), pH, cation exchange capacity (CEC), TPHs, biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), and particle size analysis. Analytical protocols include EPA (EPA 1983) and American Society of Testing and Materials (ASTM) standard methods (ASTM 1992). Onsite field measurements may include penetrometer measurements, dissolved oxygen (DO), conductivity, temperature, turbidity, oxidation/reduction potential (Eh), and VOC screening.

CDM Federal will identify and provide all necessary personnel, equipment, and materials for mobilization to and demobilization from the site for the purpose of conducting the Phase I field investigation. EPA will be responsible for contacting the property owners and formally arranging site access. All sample locations are predetermined by FIELDS and designated with universal transverse mercator (UTM) coordinates. A differential global positioning system (GPS) receiver and base station will be used to locate the sample stations.

Data quality objectives (DQOs) were developed for the Phase I sampling program based upon EPA's seven step process. The goal of the DQO process is to "help assure that data of sufficient quality are obtained to support remedial response decisions, reduce overall costs of data sampling and analysis activities, and accelerate project planning and implementation." A summary of the DQO steps follow.

The problem (Step 1) is that organic and inorganic contaminants have been detected in environmental media at concentrations that may adversely impact human health and the environment. The questions the study will attempt to resolve (Step 2) are:

- Are concentrations of contaminants present in the sediment above risk-based action levels?
- Are concentrations of contaminants present in the surface water above risk-based action levels?
- Have a sufficient number of samples been analyzed to adequately determine the concentrations of contaminants?

The inputs to the decision (Step 3) are:

- Chemical concentrations in affected media (i.e., target compound list [TCL] VOC, TCL SVOC, TCL pesticide, TCL PCB, herbicide, TAL metals, dioxin/furan, and TPH concentrations present in sediment and surface water); and

- Risk-based concentrations (RBCs); i.e., values to determine whether or not contaminant concentrations pose unacceptable risk.

The temporal boundary of the study (Step 4) is the time frame from when potential source activities began (80 years ago) to the time of the current study (1999-2000). However, the data used for decision-making will be from the most recent sampling event (October 1999 through January 2000), and possibly historical data dating back to 1992. The spatial boundaries include the physical banks of Bayou Verdine from the PPG North Dock area of Coon Island Loop to the Sabine River Aqueduct (approximately four miles in length).

Step 5 defines the parameters of interest, specifies the action levels, and integrates previous DQO outputs into a single statement that describes a logical basis for choosing among alternative actions. The parameters of interest are the concentrations and locations of constituents identified in the separate media that pose significant adverse risk. The action levels will be developed using risk-based concentrations (RBCs) as inputs.

Step 6 describes the decisions maker's tolerable limits on decision errors, which are used to establish performance goals for the data collection design. Risk-based action levels will be used as absolute values; no "gray area" around the action level will be used. However, the tolerable decision error is ± 10 percent.

The sampling design is considered optimized (Step 7) because it is based on historical data, communication with knowledgeable people familiar with the site, and a site visit.

All data collected will be validated in accordance with the National Functional Guidelines for Organic and Inorganic Parameters. All data will also be evaluated for precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. The data will be presented in an RI/FS report.

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS (continued)

SECTION **PAGE**

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

APPENDICES

FIGURES

Figure

TABLES

Table

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
As	Arsenic
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BOD	Biological Oxygen Demand
CDM Federal	CDM Federal Programs Corporation
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
cfs	Cubic feet per second
CLP	Contract Laboratory Program
cm	Centimeter
CN	Cyanide
CO	Contract Officer
COC	Contaminant of Concern
COD	Chemical Oxygen Demand
Conoco	Conoco, Incorporated
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
Cu	Copper
DO	Dissolved Oxygen
DQOs	Data Quality Objectives
EDD	Electronic data deliverable
Eh	Electronic (or oxidation/reduction) Potential
EPA	U. S. Environmental Protection Agency (Region VI)
FIELDS	Fully-Integrated Environmental Location Decision Support
ft	Feet
FSP	Field Sampling Plan
FWS	U.S. Fish and Wildlife Service
gpm	Gallons per minute
GPS	Global Positioning System
HRS	Hazard Ranking System
HASP	Health and Safety Plan

ACRONYMS AND ABBREVIATIONS (continued)

I-210	Interstate Highway 210
IDW	Investigation-Derived Waste
in	Inch
K	Hydraulic Conductivity
L	Liter
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
LDEQ	Louisiana Department of Environmental Quality
LGS	Louisiana Geological Society
MCL	Maximum Contaminant Level
msl	Mean sea level
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NGD 83	National Geodetic Datum of 1983
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
NWS	National Weather Service
Olin	Olin Industries, Inc.
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
Pb	Lead
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
PLS	Professional Land Surveyor
PO	Project Officer
PPE	Personal Protective Equipment
PPG	Pittsburgh Paint and Glass Industries, Inc.
ppm	Parts per million
ppt	Parts per thousand
PRC	PRC Environmental Management, Inc.

ACRONYMS AND ABBREVIATIONS (continued)

psi	Pounds per square inch
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RAC	Response Action Contract
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TPHs	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
Vista	Vista Chemical Corporation
VOC	Volatile Organic Compound
WAM	Work Assignment Manager
±	Plus or minus
%R	Percent recovery
EC	Degrees Celsius

ACRONYMS AND ABBREVIATIONS (continued)

EF	Degrees Fahrenheit
Fohm/cm	Microhm per centimeter
Fg/L	Micrograms per Liter

1.0 INTRODUCTION

This document is the Sampling and Analysis Plan (SAP) for Phase I of the Remedial Investigation (RI) portion of a Remedial Investigation/Feasibility Study (RI/FS) being conducted for the Bayou Verdine Area of Concern (AOC) of the Calcasieu Estuary in the Calcasieu Parish, Louisiana (Figure 1-1). Bayou Verdine is one of four AOCs within the Calcasieu Estuary being investigated (Figure 1-2). The RI for the Bayou Verdine AOC is currently proposed to be completed in three phases of investigation.

The RI/FS for the Bayou Verdine AOC is being conducted for the U.S. Environmental Protection Agency (EPA) Region VI under the EPA Region VIII Response Action Contract (RAC) No. 68-W5-0022, Work Assignment No. 041RI-CO-06FY. The RI/FS involves the investigation and characterization of organic and inorganic chemical contamination, as well as assessment of human health and ecological risk and alternatives to mitigate unacceptable levels of environmental contaminants within Bayou Verdine. Chemical contamination, primarily from local industrial activities, has been detected in the surface water, sediment, fish, and crustacea in the Bayou Verdine AOC.

This SAP describes the field investigation and support that CDM Federal Programs Corporation (CDM Federal) will provide EPA during the conduct of Phase I of the RI. These investigative activities are consistent with EPA's Statement of Work (SOW) dated June 2, 1999. The development and focus of the proposed sampling and analysis program, described herein, has been a cooperative effort among EPA, Louisiana Department of Environmental Quality (LDEQ), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (FWS), and CDM Federal.

This SAP conforms to the requirements of EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Interim Final, EPA/540/G-89/004 (EPA 1988). The Quality Assurance Project Plan (QAPP), Part II of the SAP, conforms to EPA's QA/R-5 QAPP preparation guidance (EPA 1998). The purpose of this SAP is to describe the sampling objectives, the proposed characterization tasks, the project schedule, and the quality assurance (QA) requirements for Phase I of the Bayou Verdine AOC RI. The SAP is organized as follows:

Section 1 - Introduction
Section 2 - Site Background

SAP Part I: Field Sampling Plan

Section 3 - Sampling Strategy, Locations, and Rationale
Section 4 - Field Activities, Methods, and Procedures

SAP Part II: Quality Assurance Project Plan

Section 5 - Project Management
Section 6 - Measurement and Data Acquisition
Section 7 - Assessment and Oversight
Section 8 - Data Validation and Usability

Section 9 - References

Appendix A - Systematic-Random Sampling Strategy
Appendix B - Health and Safety Plan
Appendix C - Standard Operating Procedures
Appendix D - Specialized Sampling Equipment
Appendix E - Field Forms
Appendix F - Contract Laboratory Program Protocols

1.1 OBJECTIVES OF PHASE I SAMPLING AND ANALYSIS PLAN

The objectives described below are based on EPA's SOW and a review of existing hydrogeologic and geochemical data collected during previous studies within the AOC. The specific Phase I objectives include:

- Develop data quality objectives and an analytical protocol that will allow characterization of the nature and extent of contamination within sediment and surface water, support feasibility study data needs, and support human health and ecological risk assessment data needs;

- Develop sampling protocols to characterize the nature and extent of organic and inorganic contamination in sediment and surface water within the Bayou Verdine AOC; and

- Collect data to support an evaluation of whether further action (or no further action) is required for the sediment and other potentially-impacted media within the Bayou Verdine AOC.

1.2 PROJECT SCHEDULE AND DELIVERABLES

This work assignment was initiated on May 18, 1999 with a scoping meeting at EPA Region VI offices in Dallas, Texas. A site visit followed on May 21, 1999. The period-of-performance of the work assignment is presently scheduled to end on September 30, 2000. However, characterization activities for the Bayou Verdine AOC may not be completed by the end of this work assignment. A second follow-on work assignment is planned to complete all RI/FS activities. Table 1-1 presents an abbreviated project schedule for the Bayou Verdine AOC, including CDM Federal deliverables for the Bayou Verdine RI/FS through December 2001.

2.0 SITE BACKGROUND

This section describes the site location, physiographic features, the results of previous investigations, and the environmental setting. Portions of these discussions were obtained from the *Site Investigation Report for Bayou Verdine,* prepared by PRC Environmental Management, Inc. (PRC) for EPA (PRC 1994).

2.1 SITE LOCATION AND PHYSIOGRAPHIC FEATURES

Bayou Verdine is located between the cities of Westlake and Mossville, and north-northwest of Lake Charles in Calcasieu Parish, Louisiana (Figure 2-1). Bayou Verdine's headwaters originate in the farmland north of Mossville and flow primarily south-southeast entering the Calcasieu River on the north end of Coon Island Loop. For purposes of the RI, the Bayou Verdine AOC is defined by the surface water and sediments within the bayou and immediately adjacent wetland areas which may have been impacted by industrial activity. Industrial properties adjacent to the bayou are not currently included in the Phase I investigation. The Bayou Verdine AOC is within Sections 27, 28, 33, and 34, Township 9 South, Range 9 West, and Section 3 of Township 10 South, Range 9 West. The Bayou Verdine AOC is approximately 4.2 miles long, and the bayou is the only major tributary to Calcasieu River-Coon Island Loop (NOAA 1997).

Bayou Verdine is a wetland bayou that flows through or adjacent to property owned by Vista Chemical Corporation (Vista), Conoco, Inc. Lake Charles Refinery (Conoco), and Pittsburgh Paint and Glass Industries, Inc. (PPG). These facilities are all active.

During the 1950's, the southernmost 3,500 feet of the bayou were rerouted to the west when Olin Corporation (Olin) built the West Pond over the original bayou. The former route of Bayou Verdine downstream of Interstate Highway 10 was to the east of its present course. Its former confluence with the Calcasieu River-Coon Island Loop was near its present mouth (PRC 1994).

The land around Bayou Verdine includes undeveloped, rural residential, commercial, and heavy industrial property. Heavy industry dominates the southern reaches of Bayou Verdine on both sides. Permitted industrial discharges to Bayou Verdine under the National Pollutant Discharge Elimination System (NPDES) include outfalls belonging to Vista, Conoco, and PPG. In addition, three drainage ditches, including the Vista West Ditch, the Faubacher Ditch, and the Kansas City Southern Railroad West Ditch discharge to Bayou Verdine within the AOC (Figure 2-1). These discharges (current and historic), stormwater runoff, and documented and suspected accidental releases have contributed to organic and inorganic impacts to surface water, sediment, and biota within the Bayou Verdine AOC.

No residents inhabit the site, but up to 27,000 people live within four miles of the site (PRC 1994). Neighboring populations include a number of residences within 200 feet of the bayou near New Trousdale Road and the Mossville School that is within 1,000 feet of the bayou (Figure 2-1). Although Bayou Verdine is not used as a drinking water source, the estuary surface waters have been designated by LDEQ as supporting primary contact recreation, secondary contact recreation, and fish and wildlife propagation (PRC 1994). Bayou Verdine supports limited recreational fishing and has several delineated wetlands. Health advisories warning of contaminated fish consumption have been issued for the Calcasieu Estuary, including Bayou Verdine (LDEQ 1999).

The only reported dredging on Bayou Verdine in recent history was performed by PPG in the North Dock/Barge Slip (Figure 2-1). During 1992, an estimated 10,000 cubic yards of sediment were removed (PRC 1994). This area is reportedly about 20 feet deep, over three times the average depth of the bayou (PRC 1994) and; therefore, the North Dock area is excluded from the Bayou Verdine AOC.

The Bayou Verdine AOC has not been proposed for inclusion on the National Priorities List (NPL), but the entire Calcasieu Estuary has been the subject of environmental studies dating back to the early 1970s.

2.2 PREVIOUS INVESTIGATIONS

Previous investigations indicate that surface water and sediment in the Bayou Verdine AOC are mostly contaminated by volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, total petroleum hydrocarbons (TPHs), and various inorganic elements (i.e., heavy metals). Following are documents describing previous investigations associated with Bayou Verdine.

Toxics Study of the Lower Calcasieu River. Research Triangle Institute. March 1990.

> The Toxics Study of the Lower Calcasieu River summarizes the results of a toxics study conducted by EPA Region VI, the LDEQ, and the U.S. Geological Survey (USGS). The study area included the Lower Calcasieu River, Bayou d'Inde, Bayou Verdine, Prien Lake, Lake Charles, Moss Lake, and Calcasieu Lake. Water and sediment samples were collected in June and July of 1988 and April 1989. Water samples were mid-channel, mid-depth grabs. Sediment samples were composites consisting of three grab samples (river locations). Grab samples were also collected from waste water effluents from industrial facilities. Samples were tested for VOCs, SVOCs, PCBs, pesticides, inorganic elements, anions, and conventional chemical and physical parameters. Toxicity testing of effluent, surface water, and sediment samples was performed using six different bioassay species and methods. The report concluded that a variety of organic and inorganic constituents exist in the various media, which resulted in high mortality rates. However, because of the age of data in this report, the data are not being considered in this RI.

Site Inspection for Bayou Verdine. PRC Environmental Management, Inc. May 1994.

> The Site Inspection for Bayou Verdine was focused on areas of elevated contaminant concentrations. Background information presented in this report was prepared from a comprehensive file review. The study objective was to document the presence of hazardous substances in surface water and sediments from PPG's North Dock, a section of Coon Island Loop, and Bayou Verdine (including Kansas City Southern Railroad West Ditch, the Vista West Ditch, and the Faubacher Ditch). A total of 27 sediment and 23 surface water samples were collected from 27 stations within the study area from July 19 through July 22, 1993. Sediment samples were collected from near-shore and center channel areas with dedicated aluminum push tubes. Sediment samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and inorganic elements. Sediment for the VOC analysis were discrete depth grab samples; the remaining sample interval was homogenized for the SVOC, PCB, pesticide, and inorganic elemental analyses. Surface water samples were collocated with the sediment samples; however, they were only analyzed for VOCs.

The primary contaminants of concern (COCs) identified were benzo(a)pyrene, dibenz(a,h)anthracene, 1,2-dichloroethane, 1,1,2-trichloroethane, vinyl chloride, benzene, chromium, lead, and mercury.

Results of Preliminary Sediment and Surface Water Sampling and Analysis in Bayou Verdine and Coon Island Loop of the Calcasieu River. McLaren/Hart Environmental Engineering, ChemRisk Division. 1994.

The study objective was to characterize the nature and extent of chemical contamination in Coon Island Loop (including the PPG North Dock facilities) and a section of Bayou Verdine (from Interstate Highway 10 to the Coon Island Loop) for PPG. ChemRisk established 58 sampling stations within the study area. Twelve stations were located in Bayou Verdine; 16 were located in the PPG dock area and turning basin (including two transects); 18 stations (comprising six transects) were located in the west arm of Coon Island Loop; and 12 stations (including five transects) were located in the east arm and south end of Coon Island Loop.

ChemRisk collected 33 surface water samples from 25 stations from October 1 to October 15, 1993. Bayou Verdine, the dock area and turning basin, and the east and southern Coon Island Loop locations (17 stations) were sampled at one depth, at approximately two-thirds the depth of the surface water. Coon Island Loop locations from the western arm (eight stations) were collected from the center of the dredged ship channel at two depths. All samples were collected with a Van Dorn water sampler.

ChemRisk completed multi-depth (4 inches to 9 feet) sediment borings at the 58 different locations, from which 141 sediment samples were collected. Sediment samples from Bayou Verdine reached a maximum depth of two feet. Samples were collected using a vibratory corer and a two-inch, split barrel, PVC sampler.

All surface water and sediment samples were analyzed for VOCs, SVOCs, TPHs (i.e., diesel and gasoline fractions), PCBs, chlorinated pesticides, inorganic elements, anions, ammonia, and conventional physical and chemical parameters. A grain size analysis also was performed on the sediment samples. Analytical results showed elevated concentrations of organic and inorganic contaminants in the areas sampled.

Bayou Verdine Inspection, Lake Charles, Louisiana. Conoco. 1999.

Conoco conducted a field investigation that included shallow and deep sediment and surface water sampling program and a biological inventory evaluation on Bayou Verdine. The objective of the sampling effort was to characterize the nature of chemical constituents in Bayou Verdine as well as delineate the extent of those constituents. The objective of the biological inventory was to identify representative plant and wildlife species inhabiting the area. Environmental sampling and the biological inventory were completed during 1999. Analytical protocols included VOCs, SVOCs, pesticides, PCBs, and metals in addition to numerous physical parameters. The results of the investigation were not available as of October 27, 1999.

2.3 ENVIRONMENTAL SETTING

The environmental setting includes a discussion of the local geology and soils (Section 2.3.1), the hydrogeology (Section 2.3.2), hydrology of Bayou Verdine (Section 2.3.3), and climate (Section 2.3.4).

2.3.1 GEOLOGY AND SOILS

The Bayou Verdine AOC of the Calcasieu Estuary Site is located within the Gulf Coastal Plain physiographic province of southwestern Louisiana. The area is comprised primarily of geologically young unconsolidated Quaternary (Pleistocene-age) sediments. Structurally, the area consists of a geosyncline that has been and is still receiving large quantities of sediment from multiple river discharges (Louisiana Geological Survey [LGS] 1984).

Quaternary sediments are Pleistocene-age terraces deposited on the Gulf Costal Plain during glacial retreats (PRC 1994). These sediments are typically composed of interbedded sands, gravels, silts, and clays. Four terrace deposits have been identified in Calcasieu Parish: the Williana, Bentley, Montgomery, and Prairie. The Bentley, Montgomery, and Prairie are exposed at the surface in the Calcasieu Parish. The surficial deposits in the Lake Charles area southeast of Bayou Verdine are clays, silts, fine sand, and shells of the Prairie Terrace (LGS 1984).

These Pleistocene terrace formation deposits include the “200-,” “500-,” and “700-foot” sands, that comprise the Chicot aquifer that underlies the site. These units generally thicken with depth toward the south. Faulting associated with the local Lockport and Sulphur Mines piercement salt domes may have caused the local variations in thickness and dip.

In some locations, the Pleistocene terrace deposits may be overlain by Holocene alluvium consisting of sandy and gravelly channel deposits mantled by sandy to muddy natural levee deposits, with organic-rich muddy backswamp deposits in between them (LGS 1999). The local soils consist of Basile and Guyton silt loams. These soils are frequently flooded, very low to low permeability, poorly-drained silt loams (PRC 1994). Site investigations within the AOC describe the surficial sediment in Bayou Verdine as silt with varying amounts of sand, clay and organic matter. The silt is typically black, with plant and shell fragments.

2.3.2 HYDROGEOLOGY

Significant groundwater aquifers exist below the site. Within the upper 1000 feet of Quaternary sediments, the local aquifers include a shallow unconfined aquifer and the deeper confined, Chicot aquifer. These aquifers typically consist of sand and gravel units separated by clay aquitards (PRC 1994).

There has been relatively little study of the shallow aquifer. The following description of this aquifer is based on conversations with EPA Region VI and LDEQ technical staff familiar with the area, as well as published data. The shallow aquifer is comprised of unconsolidated sand units referred to as the “10-”, “20-”, and “36-foot” sands in the vicinity of PPG (PRC 1994). Groundwater in this aquifer is unconfined and occurs at depths of less than 1 foot to 3 feet below ground surface (bgs). Groundwater flow, fluctuation, and quality may be influenced by surface water including Bayou Verdine, Vista West Ditch, and Faubacher Ditch that intercept the shallow groundwater (PRC 1994). In addition, water levels in the shallow aquifer are tidally influenced with up to several inches of daily fluctuation. Because of the local influences, groundwater flow directions are irregular and vary seasonally. The water quality is typically poor and unsuitable for domestic use. There are no known wells completed in the shallow aquifer in the vicinity of the site. Recharge to the shallow aquifer is from infiltration of precipitation, impoundments, and surface water. Groundwater may also discharge to surface water in some locations (PRC 1994).

The major hydrologic units containing potable water in the Lake Charles area are the ”200-,” “500-,” and “700-foot” sands that comprise the Chicot aquifer. These sands, like the sand units described above are locally named for the approximate depth at which they occur. The actual depths vary with location. The Chicot aquifer is a major source of groundwater for public supply, irrigation, and industrial use. This aquifer is characterized by alternating sands and clays, with individual hydrologic units showing variations in homogeneity and continuity. Yields from wells completed in the “200-foot” sand range from 25 to 450 gallons per minute (gpm); in the “500-foot” sand from 19 to 3800 gpm; and in the “700-foot” sand from 27 to 2200 gpm (LGS 1984). The specific capacity of the Chicot aquifer ranges from 2 to 23 gallons per minute per foot. The hydraulic conductivity ranges from 40 to 220 feet per day (LDEQ 1996).

Recharge to the Chicot aquifer is primarily through infiltration of precipitation in outcrop areas in northern Calcasieu Parish. Although the ”200-,” “500-,” and “700-foot” sands are generally confined by silt and clay layers, they are hydraulically connected. Substantial amounts of recharge in the “500-foot” sand results from the downward movement of water from the “200-foot” sand and the upward movement of water from the “700-foot” sand. The “700-foot” sand is recharged from the underlying Evangeline aquifer (LGS 1984).

Groundwater within the Chicot aquifer occurs first within the 200-foot sand at a depth of approximately 110 to 120 feet bgs (USGS 1994). Water levels in the Chicot aquifer in the Lake Charles area are reported to be declining steadily at a rate of about one foot per year, with the exception of seasonal fluctuation (USGS 1994). Heavy pumping in the Lake Charles area has created a cone of depression, such that the groundwater flows toward Lake Charles in a concentric pattern from surrounding areas (LGS 1984).

2.3.3 HYDROLOGY OF BAYOU VERDINE

Bayou Verdine is approximately four miles long. Relief in the area of the bayou ranges from 5 to 15 feet above national geodetic vertical datum (NGVD). The area surrounding Bayou Verdine is located within the 100-year flood plain of the Calcasieu River Basin (PRC 1994). Its headwaters are freshwater that mix with brackish to saline water of the Calcasieu River to the south. According to the FWS National Wetland Inventory Map, the upper reaches of Bayou Verdine (from point of origin to I-10) is comprised of a palustrine wetland system that is periodically flooded during storm events, and a riverine segment that is permanently flooded. The upper reaches of the bayou have water depths ranging from 1.2 to 2.1 meters (m) [approx 4-7 feet], and are not tidally influenced. The lower segment of the bayou is tidally influenced with up to three inches of daily water level fluctuation, and has depths of up to 6 m (20 feet). The bayou has an estimated average rate of flow of approximately eight cubic feet per second (cfs) in its southern reaches. Near the confluence of Bayou Verdine and the Coon Island Loop (Figure 2-1), Bayou Verdine and the shallow groundwater are in direct communication (PRC 1994).

2.3.4 CLIMATE

The climate in Calcasieu Parish is humid and temperate, and is influenced by its proximity to the Gulf of Mexico. The average year-round temperature is 68 degrees Fahrenheit (^{B}F), with an average daily high of 78 ^{B}F and an average daily low of 58 ^{B}F. The hottest months are July and August with average high and low temperatures of 91^{B}F and 73 ^{B}F, respectively. The average high and low temperatures for the coolest months, January and February are 63 ^{B}F and 41 ^{B}F, respectively.

Precipitation is relatively uniform from year to year. The average annual precipitation is 54.05 inches, with an average number of 103 rainy days (National Weather Service [NWS] Southern Region Climate Center 1999). May, June, and July typically experience the most precipitation, whereas March and October are the driest months. The average wind speed is 8.6 miles per hour, from the south.

Hurricane season officially runs from June 1st to November 30th. The Gulf Coast is vulnerable to hurricanes because of its proximity to tropical waters and because the warm water of the

Atlantic Ocean and the Gulf of Mexico are attractive to storm growth. The last hurricane to actually traverse Lake Charles was hurricane Audrey in 1957. From 1886 through 1997, 71 tropical storms of which 34 were hurricanes, came within 150 nautical miles of Lake Charles (NWS 1998). Typical storm impacts for the Calcasieu Estuary include tornadoes, floods, and storm surges that can raise the water level to several feet above normal.

SAP PART I: FIELD SAMPLING PLAN

3.0 SAMPLING STRATEGY, LOCATIONS, AND RATIONALE

The Field Sampling Plan (FSP) is included in Sections 3.0 and 4.0. This section describes overall sampling strategy for the Bayou Verdine AOC (Section 3.1), sediment sample location and rationale (Section 3.2), and surface water sample location and rationale (Section 3.3).

3.1 SAMPLING STRATEGY

The Phase I sampling is designed to support risk characterization and determination of the nature and extent of organic and inorganic contamination within the Bayou Verdine AOC. This section addresses both spatial coverage (Section 3.1.1) and randomness (Section 3.1.2) in the selection of sampling locations. Proposed Phase II and III sampling, not discussed herein, will address data gaps (e.g., areas with high error variance), hot spot delineation (i.e., refining the extent of contamination within the AOC), tissue sampling, and contaminant gradients within the sediment and surface water for ecological risk considerations.

3.1.1 SPATIAL COVERAGE CONSIDERATIONS

The number of samples proposed for collection within the AOC considers the following: (1) the limits of the AOC, (2) the varying physical features (including land use, inputs, etc.) of the bayou, (3) the location and concentration of historical data, and (4) EPA's Fully-Integrated Environmental Location Decision Support (FIELDS) software. Each referenced input sample coverage is described below.

- **The boundaries of the Area of Concern**. The AOC for Phase I sampling is defined as the area potentially used by risk receptors: local residents, fishermen and/or top predators such as alligators. The boundaries consist of the footprint of surface water within the main channel of the bayou, as determined from orthotopographic photographs (Figure 3-1). These boundaries define the width-wise extent of sediment and surface water in the bayou. The length-wise extent is defined by the furthest historic upgradient sampling point and the mouth of the bayou. Tributary drainage ditches, the PPG north dock area, and a variety of detached impoundments on the fringes of the bayou were not considered part of the bayou for Phase I. These secondary areas may be addressed in a later phase of sampling.

- **Subdivision of the AOC into reaches.** The bayou has been subdivided into five reaches, each of which have unique physical characteristics. A description of the five reaches are presented in Table 3-1 and they are shown in Figure 3-1. Reaches 1 through 3 comprise the Industrial segment and Reaches 4 and 5 comprise the Residential segment. The Industrial and Residential sections will be evaluated separately in the site characterization and risk assessment tasks for Bayou Verdine.

- **The location and concentration of historical data**. Statistical evaluation of sediment and surface water data collected from Bayou Verdine after January 1, 1992 was used to determine the mean, mean variance, and the number of samples needed for a pre-determined confidence interval and power (Appendix A). Data prior to 1992 were not considered because of the age of the data. Data beyond the limits of the AOC were not used, because they are not considered representative of the AOC. The number of samples calculation (based on historical data) was used as input criteria to EPA Region V FIELDS software.

- **EPA's FIELDS sample location selection software**. The FIELDS software is an ArcView software extension tool for dividing up an irregular polygon into any number of systematic grid-aligned triangles or squares for sampling. This approach allows for statistically valid sampling programs for characterizing nature and extent of contamination. FIELDS subdivides the AOC into grids of equal area based on either the number of available samples or on the maximum diameter of a "hot spot" (i.e., an area with unacceptable concentrations of contaminants) that would be left uncharacterized by the sampling effort. With systematic algorithms, the FIELDS program selects a sampling point in the center of each equi-area grid cell, or a random node within the grid to employ randomness to the data collected.

3.1.2 DESIGN STRATEGY

The rationale for the proposed systematic-random sampling design is a compromise between the data needs for characterizing nature and extent and evaluating potential risks. Characterizing nature and extent of contamination requires a statistically valid number of samples systematically spaced throughout the AOC. Under this data collection strategy, analytical data are compared to action levels on a point-by-point basis. Maximizing spatial coverage, location of hot spots, and determination of extent of contamination is facilitated by systematic sampling.

Human health risk assessment, on the other hand, requires data randomness for estimating mean concentrations and variances as inputs to risk assessment equations. Mean concentrations and variance determinations require simple-random or stratified-random sampling in order to avoid biased results. Therefore, human health risk assessment requires simple-random or stratified-random sampling.

Use of strictly systematic grid-aligned locations for sampling would introduce unwanted bias in mean and variance calculations required for risk assessment and nature determinations. This obstacle is overcome by introducing randomness into systematic sampling. The melded systematic-random program establishes a number of equal area grid cells along the AOC using FIELDS (Appendix A). The specific node to be sampled within each grid is randomly selected. This randomly-selected node is then sampled for all grids. This sampling approach is called multiple systematic or systematic-stratified sampling (Sections 8.4.1 and 8.4.2; Gilbert 1987).

The Bayou Verdine AOC was divided into 50 grid cells; 25 grids each in the Residential and Industrial segments of the bayou (Figure 3-1). For risk assessment, the mean and variance of each constituent is calculated from the data from each segment. For nature and extent, the data are considered unique and they will be used collectively throughout the entire bayou. Data quality objectives (DQOs) for the Bayou Verdine AOC are described in Section 5.4.

3.2 SEDIMENT SAMPLING

Sediment samples will be collected and analyzed to (1) obtain general data including lithology, physical characterization, and sediment thickness (if possible) and (2) for chemical characterization for nature and extent and risk assessment evaluations. Sample data will also support the feasibility study and potential future remedial actions. Most sediment samples will be surface grab samples (i.e., 0 to 15-centimeter [cm] [6-inch] (in) depth). However, vertical profiling of the sediment will be conducted at selected locations. The number of sediment samples and the proposed analytical protocol are described below. Sample collection techniques are described in Section 4.0.

3.2.1 SEDIMENT SAMPLE NUMBER AND LOCATION

Sediment samples collected from the Bayou Verdine AOC will include the following type and number of samples.

- 50 “random” surface sediment characterization samples collected from the 0 to 15-cm (6-in) depth interval.
- 20 multi-depth sediment “vertical profile” samples collected from two discrete depth intervals (e.g., 15 to 30-cm [6 to 12-in] and 30 to 45-cm [12 to18-in] depth intervals) at 10 of the 50 above-referenced surface sediment sampling locations.
- 7 quality control samples (i.e., duplicates), as well as four extra volume samples for matrix spike/matrix spike duplicate (MS/MSD) analyses; other QC samples are included in Section 3.3 (i.e., equipment rinse and trip blanks).

The 50 random samples will be collected from the thickest sequence of sediment at each sample location. Prior to sampling, the sediment thickness at mid-channel, right bank, and left bank will be measured with a push probe. The mid-channel location is preferable.

The 20 multi-depth sample locations, described above, will be selected based on the maximum number and concentration of SVOCs measured in the surface sediment samples. The measured SVOC concentrations will be available through 72-hour analytical turnaround times. A maximum of two multi-depth sample locations will be completed in each of the five reaches on Bayou Verdine.

A description of each sample, the sample coordinates, data use, sample container requirements, and analytical methods are summarized in Table 3-2. The locations of the sediment samples are shown in Figure 3-1. If a proposed sediment sample location cannot be sampled because of access limitations, obstructions, or some other technical difficulty, the sample will be relocated as close to the selected location, as possible. New coordinates will be established.

3.2.2 SEDIMENT SAMPLE ANALYTICAL PROTOCOL

Sediment samples collected from the Bayou Verdine AOC will be analyzed offsite. Three potential analytical laboratories will be used including a subcontract laboratory, EPA's Regional (Region VI) Laboratory, and EPA's Contract Laboratory Program (CLP). The analytical protocol includes target analyte list (TAL) metals, VOCs, SVOCs, pesticides, herbicides, PCBs, and dioxins/furans. Dioxins/furans analyses will be limited to 20 percent of the samples. Analytical protocols include EPA SW-846 (EPA 1997) and EPA CLP standard methods, as listed in Table 3-3 and in Part II of this SAP. Sample allocation between the various laboratory programs is also listed in Table 3-3.

Ancillary testing of sediment (i.e., 20 percent of the surface sediment samples) performed by the offsite subcontract laboratory includes total organic carbon (TOC), pH, cation exchange capacity (CEC), TPHs, and particle size analysis. Analytical protocols include EPA (EPA 1983) and American Society of Testing and Materials (ASTM) standard methods (ASTM 1992) (Table 3-4). Onsite field measurements will be limited to penetrometer measurements, oxidation/reduction potential (Eh), and VOC screening (Table 3-4).

3.3 <u>SURFACE WATER SAMPLING</u>

Surface water samples will be collected at selected locations and analyzed to characterize (1) the physical characteristics and (2) the chemical characteristics of the surface water column within the Bayou Verdine AOC. Like sediment, these data will also support the nature and extent and risk assessment evaluations. These analytical data may also support the feasibility study and possibly future remedial operations.

Historical data has shown that the water in Bayou Verdine may partition from shallow fresh (or brackish) water to deeper saltier brackish-water. Bayou Verdine within Reach 5 is composed of a nontidal wetland where the salinity is below 0.5 parts per thousand (ppt). Reaches 3 and 4 also are not believed to be tidally influenced, but may have higher salinity content. Reach 1 and possibly Reach 2 are tidally influenced and may have measurable salinity gradients.

Prior to sample collection, physical parameters (e.g., temperature, pH, conductivity, salinity, etc.) will be measured at the surface, then in two-foot increments through the entire water column. Salinity values will be used to determine the transition from shallow fresh water to deeper more saline, brackish water. The FWS salinity classification scheme will be used to characterize the salinity-depth profile. Bayou Verdine surface waters will be classified with respect to salinity as follows: fresh (less than 0.5 ppt), oligohaline (0.5 to 5 ppt), mesohaline (5 to 18 ppt), polyhaline (18 to 30 ppt), and euhaline (30 to 40 ppt) [FWS, 1979]. Based on historical data, only three of the classifications apply to Bayou Verdine's waters, fresh, oligohaline or slightly brackish, and mesohaline or moderately brackish (Table 2-1).

When the salinity-depth profile indicates shallow water over slightly brackish water (oligohaline), or slightly brackish water over moderately brackish water, then two surface water samples will be collected, one from each layer. The shallow sample will be collected from the upper one-third of the water column. Whereas, the deep sample will be collected from the bottom one-third of the water column. If the salinity-depth profile indicates no vertical salinity gradient, one surface water sample will be collected from the middle of the water column.

3.3.1 SURFACE WATER SAMPLING NUMBER AND LOCATION

Surface water samples collected from the Bayou Verdine AOC will include the following type and number of samples.

- 12 deep surface water characterization samples collected from the bottom one-third of the water column; each sample being systematically-spaced (approximately 1000 to 1500 feet apart) and collocated with a shallow sediment sample.

- 12 shallow surface water characterization samples collected from the upper one-third of the water column; each sample being collocated with the above-referenced deep samples.

- Four quality control samples, consisting of four duplicates, in addition to two extra volume samples for matrix spike/matrix spike duplicate (MS/MSD) analyses, as needed.

A description of each sample, the sample coordinates, and data use are summarized in Table 3-2. The locations of the surface water samples are shown in Figure 3-1. Because all surface water samples are collocated with sediment sampling locations, there are no sample relocation contingencies resulting from access limitations or obstructions.

3.3.2 SURFACE WATER SAMPLE ANALYTICAL PROTOCOL

Surface water samples collected from the Bayou Verdine AOC will be analyzed by offsite laboratories, including CDM Federal's subcontract laboratory, EPA's Regional (Region VI) Laboratory and EPA's CLP. The analytical protocol includes TAL metals, VOCs, SVOCs, pesticides, herbicides, PCBs, and dioxins/furans. Dioxins/furans analyses will be performed on 20 percent of the samples. Surface water samples for metal analyses require filtered and unfiltered aliquots for dissolved and total concentrations, respectively. Analytical protocols include EPA SW-846 and EPA CLP methods, as listed in Table 3-3 and in Part II of this SAP. Sample allocation between the laboratory programs is also listed in Table 3-3.

Ancillary testing of surface water performed by the offsite subcontract laboratory includes alkalinity, ammonia (as nitrogen), hardness, biological oxygen demand (BOD), chemical oxygen demand (COD), TOC, total dissolved solids (TDS), total suspended solids (TSS), total Kjeldahl nitrogen (TKN), TPHs, and major anions using EPA or ASTM standard methods. Onsite field measurements will include pH, Eh, temperature, conductivity, dissolved oxygen (DO), and salinity (Table 3-4).

3.4 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Quality assurance/quality control (QA/QC) samples will also include equipment rinsate blanks and trip blanks (Table 3-3). Method-required MS/MSD volumes for laboratory QA/QC are included in Table 3-3. The number of QA/QC samples collected during the field investigation for both sediment and aqueous samples includes:

C 74 quality control samples, including 18 rinsates and 56 trip blanks.

The frequency of collection is described in Section 5.4.2.4.

3.5 INVESTIGATION-DERIVED WASTE SAMPLING

Investigation-derived waste (IDW) includes only wash and rinse water from the equipment decontamination process. All remnant sample volume will be rinsed into the bayou. The IDW generated during the field investigation will be contained for future disposal. Representative composite samples will be collected from aqueous waste stream containers for disposal characterization. Characterization will identify concentrations of constituents in the waste streams for comparison to regulatory disposal standards. These analyses will determine whether or not the wastes are considered characteristically hazardous.

A total of three IDW samples will be collected from the aqueous waste stream (Table 3-3). The IDW samples will be composites, as described below. No QC samples will be collected or analyzed for this media.

Representative aliquots will be collected from the aqueous IDW containers and composited into three samples; one-third of the aliquots per sample. Personal protective equipment (PPE) will not be retained as IDW and, instead, these materials will be decontaminated then disposed as municipal waste. The IDW samples will be analyzed for Resource Conservation and Recovery Act (RCRA) metals, VOCs, SVOCs, pesticides, and PCBs (Table 3-3). The aqueous samples will not be filtered and, therefore, the analytical results will reflect total metal concentrations.

4.0 FIELD ACTIVITY METHODS AND PROCEDURES

The following is a summary of field activities that will be performed by CDM Federal personnel and/or subcontractors for the Bayou Verdine AOC.

- Site mobilization/demobilization.
- Site access, ingress, and egress.
- Utility clearance.
- Surveying.
- Equipment, supplies, and containers procurement.
- Bayou Verdine sediment sampling.
- Bayou Verdine surface water sampling
- Field instrumentation operation and maintenance.
- Equipment decontamination.
- Investigation-derived waste handling, sampling, and disposal.

All field activities will be conducted in accordance with the site-specific HASP (Appendix B). The proposed field activities described in Section 4.0 reference CDM Federal standard operating procedures (SOPs), where applicable, or provide site-specific procedures if there are no applicable SOPs. Referenced SOPs are included in Appendix C. Specialized equipment that may be used during the field work is presented in Appendix D. Forms that may be used during the field investigation activities are included in Appendix E. EPA's CLP sample handling requirements are included in Appendix F.

4.1 SITE MOBILIZATION AND DEMOBILIZATION

CDM Federal will identify and provide all necessary personnel, equipment, and materials for mobilization to and demobilization from the site for the purpose of conducting the Phase I field investigation. A temporary site office will be established at a local marina (i.e., Bowtie Marina on

Contraband Bayou) or at Lafluer State Park. Both areas are accessed from I-210, east of the Calcasieu River bridge.

Equipment procurement includes ordering and purchasing of equipment and supplies. An equipment list has been prepared and any equipment not maintained in inventory will be obtained (Section 4.3). One additional unit of most field monitoring instrument, such as pH meters, salinity meters, and photoionization detectors (PIDs) will be maintained onsite in case of instrument malfunction or damage.

Prior to sample collection, a decontamination pad and IDW staging area will be established near the site office, as necessary. A portable decontamination area may also be set up and used because of the remoteness of portions of Bayou Verdine.

Partial demobilization may be conducted after the Phase I sampling event for the Bayou Verdine AOC. Rented field equipment may be returned and personnel may leave the site. However, complete demobilization will not be completed until all Phase I field sampling events (i.e., the other three AOCs) are completed. Demobilization is not addressed further in this SAP.

4.2 ACCESS AND SAMPLING PERMISSION

CDM Federal has identified all private property owners along Bayou Verdine (Table 4-1). Although sampling is proposed exclusively within Bayou Verdine, unrestricted passage to all proposed sampling locations may not be possible via boat. Access to private roads and other throughways may be needed for sampling and/or equipment or sample transfers.

CDM Federal will review access requirements for Bayou Verdine during the proposed field reconnaissance event. EPA will be notified of all private property access needs two weeks prior to mobilization. EPA will be responsible for contacting the property owners and formally arranging site access. A copy of all access agreements will be provided to CDM Federal a minimum of three days before sampling begins. CDM Federal will coordinate with individual private property owners concerning specific sampling dates once formal access agreements are received.

4.3 UTILITY CLEARANCES

Utilities and submerged pipelines will be located before any intrusive subsurface sampling activities are performed. Utility clearances will be obtained by calling Louisiana One Call and private property to ensure that no underground utilities exist at the proposed sampling sites. In addition, the Coast Guard will be notified of the sampling, as appropriate. If underground or submerged utilities are present at a specific sampling location, the sampling location will be moved to avoid the utility.

4.4 EQUIPMENT, SUPPLIES, AND SAMPLE CONTAINERS

Table 4-2 lists equipment and supplies necessary to support the field sampling activities. This table separates field items into the following categories; sampling, health and safety monitoring, equipment and personal decontamination, and general field operations.

A portion of the sample containers, preservatives, and coolers needed to collect and contain the environmental samples for analytical testing will be provided by the subcontract laboratories, if applicable. Approximately one-half of the required containers and preservatives will be procured for CLP analyses. These containers are listed in Table 4-2. All sample containers will be certified precleaned and traceable to the facility that performed the cleaning. Sampling containers will not be cleaned or rinsed in the field. A list of specific containers and preservatives by analytical method is included in Tables 3-2 and 6-1.

4.5 SURVEYING

All sample locations are predetermined by FIELDS and designated with universal transverse mercator (UTM) coordinates (Table 3-2). A differential global positioning system (GPS) receiver and base station will be used to locate the sample stations. Surveying information will be managed in a database and available for base maps and data reports. One field sampling team member will be responsible for locating and managing the surveying data. Actual UTM coordinates will be established at each sample location.

4.6 SEDIMENT SAMPLING

Both surface and multi-depth sediment samples will be collected from Bayou Verdine. Surface sediment (Section 4.6.1) will be collected from the 0 to 15-cm (0 to 6-in) depth interval. The thickest sequence of sediment at each location will be sampled (i.e., left bank, center, or right bank). Multi-depth samples (Section 4.6.2) will be collected from depth intervals of 15 to 30-cm (6 to 12-in) and 30 to 45-cm (12 to 18-in). The lithology of the sediment at each sample location will be described and recorded in accordance with CDM Federal's SOP 3-5, Lithologic Logging (Appendix C). Field forms are included in Appendix E. Because of the sample volume needed to complete the proposed analytical protocol, multiple iterations of sample collection or simultaneous deployment of multiple sampling devices may be required. All samples will be contained and submitted for chemical analyses as described in Sections 6.2 and 6.3. Sample locations are described in Section 3.2. Sample numbering is described in Section 6.3.1.1. The proposed analytical protocol is presented in Tables 3-3 and 6-1.

4.6.1 SURFACE SEDIMENT SAMPLING

Surface sediment samples will be collected from Bayou Verdine using a floating platform or a low-draft boat. These samples will be used for characterization of nature and extent and risk assessment. A flat-bottom boat or a timber bridge may be required to access these locations in very narrow and or shallow stretches of the bayou. Specific equipment used to obtain samples of the shallow sediment includes a petite Ponar®, modified Ekman® dredge, or dedicated aluminum push tubes (Appendix D). All sediment samples will be collected in accordance with CDM Federal's SOP 1-1, Surface Water and Sediment/Sludge Sampling (Appendix C).

4.6.2 MULTI-DEPTH SEDIMENT SAMPLING

Samples of sediment will also be collected from depth intervals of 15 to 30-cm (6 to 12-in) and 30 to 45-cm (12 to 18-in) at selected locations within Bayou Verdine using a floating platform or a low-draft boat. These samples are to evaluate contaminant concentrations in the vertical profile in areas of highest SVOC concentrations in surface sediments. A flat-bottom boat or a timber bridge may be required access these sample locations in very narrow and/or shallow stretches of the bayou. Specific equipment used to obtain samples of the shallow sediment includes a gravity corer or dedicated aluminum push tubes (Appendix D). All sediment samples will be collected in accordance with CDM Federal's SOP 1-1, Surface Water and Sediment/Sludge Sampling (Appendix C).

Upon sample retrieval, the VOC sample will be collected first. The remainder of the sample will be homogenized in a decontaminated stainless steel bowl or dedicated aluminum pan. After homogenization, the remaining sample containers will be filled. With multiple iterations of sampling at a single location, the depth of collection must be equal (i.e., preference should be give to lateral adjustments, rather than adjustment in the vertical profile). The proposed analytical protocol is identified in Table 3-3.

4.6.3 GENERAL SEDIMENT SAMPLING PROCEDURE

Sediment sampling will consist of the following steps.

1) Calibrate all field monitoring equipment in accordance with manufacturer's instructions and SOP 5-1 (Appendix C). Record all calibration information on the calibration form. Perform continuing calibrations at least once during the day, or as needed.
2) Gather required equipment and navigate to the sampling site using predetermined coordinates and differential GPS unit. Note that the surface sediment sample collection will progress from downstream locations to upstream locations. In addition, at collocated surface water sample locations, the surface water sampling will be conducted prior to sediment sampling to avoid cross-contamination of the water samples (Refer to Section 4.7). Deep sediment samples will be collected at least three days later based on 72-hour turn around SVOC analyses.
3) Stabilize the boat at each sample location by deploying a "spud" into the sediment on opposite corners of the boat. An anchor should not be used because of sediment disturbance. Monitor the position of the actual sampling location with the GPS unit.
4) Measure the surface water column thickness (depth to sediment using a calibrated, weighted probe) from a downstream location (i.e., back of boat if sampling from the front or sides). Probe the middle and two sides of the bayou to locate the thickest sediment sequence.
5) Set up the sediment sampling equipment as described in Section 5.4 of SOP 1-1 (Appendix C). The top of sediment and the sample interval to be collected should be marked appropriately on the drop line or push rod, so the actual deployment depth of the sampler can be determined at each location. It is recognized that depth measurements using this method will be approximate.
6) Collect samples at the predetermined depths from the thickest sequence of sediment in accordance with Section 5.4 of SOP 1.1 (Appendix C). Collect sufficient sample to fill all sample jars. Set aside an aliquot of sample for physical testing. Contain, label, and handle all samples in accordance with Section 6.0.
7) Log the sediment in accordance with SOP 3-5 (Appendix C). Measure and record physical parameters including stiffness (with a penetrometer) and Eh on the borehole log form (Appendix E).
8) Rinse any extra sample volume and the sampler in the bayou. Scrape off excess sediment, as needed. Decontaminate the sampling equipment in accordance with SOP 4-5 (Appendix C). Retain all decontamination and rinse water for future disposal.

4.6.4 SEDIMENT SAMPLING CONTINGENCY

Alternative sediment sampling techniques were evaluated in the event that the three proposed methods fail in the collection of sediment samples for analysis and lithology. Three contingent methods are described below:

- **Ponar® Sampler:** This sampler is a larger version of the petite model. It weighs approximately 50 pounds, as opposed to the 25-pound weight of the petite model and the 10-pound Ekman® Dredge. Advantages include identical operation, improved function in stiffer/coarser substrates, and larger sample volumes. Disadvantages include more difficult deployment/retrieval and depth control in soft substrates.

- **Sludge Core Sampler:** This sampler is a 3-inch diameter by 12-inch long stainless steel core barrel with acrylic liners. The cutting shoe has a butterfly mechanism that closes during retrieval to retain loose sediments. The sampler is pole-mounted, light weight, and deployable in most substrates. The only disadvantage is low volume of sample and deployment difficulty in deep water.

- **Vibratory Core Sampler:** This type of sampler is power driven. It is typically available in a variety of sizes with core barrels ranging 2 to 4 inches in diameter and 5 to 20+ feet in length. Weights of the samplers range from 300 to 1200 pounds. Advantages include the ability to collect samples at depth in practically any type of substrate. Disadvantages include need for a specialty contractor to operate the sampling system, specialty boats for deployment, and possibly additional sampling team member support.

Implementation of either of the hand sampling devices could be achieved with minimal disruption of the field sampling program. If vibratory coring is required, the EPA RPM will be notified for consultation and written approval. Vibratory coring would likely require special procurement and a larger sampling team, and a result in a cost and schedule modification.

4.7 SURFACE WATER SAMPLING

Both shallow and deep surface water samples will be collected from Bayou Verdine. Shallow surface water samples will be collected from the upper one-third of the water column. Deep surface water samples will be collected from the bottom one-third of the surface water column. All surface water samples will be collocated with surface sediment samples. Surface water samples will be collected prior to sediment samples starting downgradient and preceding upgradient to avoid the collection of turbid samples and the possibility of cross-contamination.

Surface water sampling procedures will follow CDM Federal's SOP 1-1, Surface Water and Sediment/Sludge Sampling (Appendix C). Physical parameters will be measured at the surface, then in two-foot increments throughout the water column at each sample location. Because of the sample volume necessary to complete the proposed analytical protocol, multiple iterations of sample collection, simultaneous deployment of multiple sampling devices, or a peristaltic pump may be required. However, VOCs will not be collected with a peristaltic pump. The samples for metals analyses require filtered and unfiltered aliquots for both dissolved total metals concentrations. All samples will be contained and submitted for chemical analyses as described in Sections 6.2 and 6.3 . The number of samples and sample location are described in Section 3.3. Sample numbering is described in Section 6.3.1.1. The proposed analytical protocol is presented in Tables 3-3 and 3-4.

Samples of surface water will be collected within Bayou Verdine using a floating platform or a low-draft boat. A flat-bottom boat or a timber bridge may be required to access the sample locations in very narrow and or shallow stretches of the bayou. Specific equipment used to obtain samples of the surface water includes a horizontal Kemmerer® water sampler, a Van Dorn® bottle, and/or a peristaltic pump with dedicated tubing (Appendix D). During sample retrieval, the VOC sample will be collected first.

Surface water sampling will consist of the following steps:

1) Calibrate all field monitoring equipment in accordance with manufacturer's instructions and SOP 5-1 (Appendix C). Record all calibration information on the calibration form. Perform continuing calibrations at least once during the day, or as needed.
2) Gather required equipment and navigate to the site sampling using predetermined coordinates and the differential GPS unit. Note that surface water sample collection should progress from downstream locations to upstream locations. In addition, surface water sampling will be conducted prior to sediment sampling at each location.
3) Stabilize the boat at each location using a "spud" on opposite corners of the boat. No anchor should be used because of the potential for stirring up sediment. Monitor the actual position of the sample location with the GPS unit.

4) Measure the surface water column thickness (depth to sediment using a calibrated, weighted probe) from a downstream location (i.e., back of boat if sampling from the front or sides). Record depth of the water column.
5) Set up peristaltic pump with clean tubing as described in Section 5.3.2 of SOP 1-1 (Appendix C). The length of drop tubing from the pump should be equal to the depth of the water column so the bottom of the water column can be evaluated. The bottom sediments must not be disturbed.
6) Adequately mark the drop tubing for depth control. The tubing may be attached to an aluminum telescoping pole using inert nylon wire ties to maximize depth measurement accuracy and minimize current deflections. The tubing inlet should be at least 15-cm (6-in) away from the pole to minimize potential chemical impacts from the pole.
7) Collect aliquots of surface water at 1- to 2-foot increments from the surface to the total depth of the water column for physical testing. One-foot intervals should be used if the surface water column is less than or equal to 10 feet deep. Two-foot intervals should be used if the water column is over 10 feet deep. Allow the pump to purge for at least two minutes prior to collecting a sample for physical testing. A flow through cell, 500-ml sample jar, or equivalent container may be used to collect and contain the sample. It is not necessary to use clean tubing or clean sample jars for these physical tests.
8) Measure and record physical parameters including pH, Eh, temperature, conductivity, salinity, dissolved oxygen, and turbidity for each sample interval on the well purging field form (Appendix E).
9) Do not disrupt surface sediment at the bottom sampling depths.
10) Determine whether one or two water samples are needed based on the salinity profile. Note: two samples should be collected if more than one salinity zone is identified (i.e., 0-0.5 ppt, 0.5 to 5 ppt, 5 to 18 ppt, 18 to 30 ppt, and >30 ppt); one fresh and one saline.
11) Collect samples at the predetermined depths in accordance with Sections 5.2 and 5.3 of SOP 1.1 (Appendix C) for analytical testing using the Kemmerer® or Van Dorn® horizontal bottle sampler. Collect the shallow surface water samples first. Contain, label, and handle all samples in accordance with Section 6.0. Dedicated tubing must be used if the peristaltic pump is used to collect surface water samples for offsite analyses. In addition, the VOC samples should not be collected by pumping.

4.8 FIELD INSTRUMENTATION PROCEDURES

Several instruments will be used in the field by CDM Federal and/or subcontractor personnel. A PID will be used to monitor the breathing zone for health and safety requirements, as well as VOC screening of samples. Other field equipment may include instruments to measure screening level data such as pH, Eh, conductivity, temperature, DO, salinity, and turbidity of surface water and/or sediment. All instruments will be calibrated and operated in accordance with manufacturers' instructions. The following subsections briefly describe the instruments and their general use. While the following procedures are applicable to most instruments, field personnel should consult the manufacturers' instructions manual for each specific instruments prior to use.

4.8.1 CONDUCTIVITY, PH, AND TEMPERATURE METERS

The conductivity, pH, and turbidity meters are typically used to measure conductivity in the range of zero to 20,000 micromhos/centimeter (µmhos/cm), pH in the range of zero to 14 pH units, and temperature in the range of zero to 160EF. Conductance should have an accuracy of plus or minus (±) 2 percent at 77 EF, pH has an accuracy of ± 0.05 pH at 77 EF, and temperature an accuracy of ± 2 EF.

4.8.2 TURBIDITY METER

The turbidity meter is used to measure the turbidity of an aqueous solution. Turbidity measurements will be obtained during surface water sampling. Turbidity in a liquid is a result of "suspended solid matter." Turbidity is of interest because it affords an indirect way to evaluate the concentration of the "suspended solid matter." Measurements are indirect, in that, the solids are not measured: instead, their interaction with light is measured. The handling of the sample tubes and the preparation of the sample is of utmost importance. The glassware must be clean and defect-free. Scratches and/or abrasions may permanently affect the accuracy of the readings.

4.8.3 Eh, SALINITY, AND DISSOLVED OXYGEN METERS

A YSI Water Quality Monitoring System (or equivalent) with a flow-through cell or submersible probe may be used to collect Eh, salinity, and DO measurements. These parameters are screening level data that will be used to evaluate stratification of surface water in Bayou Verdine.

A positive value for the Eh indicates that the environment is oxidizing, whereas a negative value indicates that the environment is chemically reducing.

4.9 EQUIPMENT DECONTAMINATION

All reusable equipment used to collect, handle, or measure samples will be decontaminated in accordance with CDM Federal SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites (Appendix C). All equipment must be properly decontaminated before contact with any sample. Decontamination of equipment will occur either at the stationary decontamination area or at portable decontamination areas set-up at specific sampling locations. All deviations from the decontamination procedures will be recorded in the applicable field logbook.

4.10 INVESTIGATION-DERIVED WASTE TRACKING

The CDM Federal RI Task Manager will ensure that all IDW is handled in accordance with CDM Federal SOP 2-6, Guide to Handling of Investigation-Derived Waste, (Appendix C). An IDW staging area will be established at or near the field office. IDW will consist of only aqueous waste. The aqueous waste stream will consist primarily of decontamination and rinse water. The wastes will be stored in appropriate containers (55-gallon drums), on appropriate containment, in a secured area, and preferably covered with a tarp.

IDW samples will be collected from aqueous waste containers for analysis. The aqueous samples will be composites, collected as grab samples from each drum after the liquid waste has been mixed then combined. Three aqueous composite IDW samples will be collected from the liquid waste drums. The IDW samples will be submitted and analyzed as presented in Table 3-3. PPE will be decontaminated and disposed as municipal waste.

If the aqueous waste sample analyses are less than the regulatory levels established for TCLP, it will be disposed of at a local wastewater treatment plant. Because Work Plan Revision No. 1

assumes only non-hazardous IDW will be generated for disposal, if any of the IDW waste samples fail TCLP testing, handling and disposal of hazardous waste will require a cost and schedule modification. CDM Federal will be responsible for characterizing and arranging for disposal of IDW. EPA will sign the appropriate transport/disposal documentation (i.e., the manifest or bill of lading for hazardous or nonhazardous waste, respectively).

To prevent the inappropriate disposal of this waste, a tracking system will be implemented to document the amount of contamination present in the waste, so that proper disposal methods can be used. The waste tracking will be performed by the CDM Federal Site Manager. Waste tracking includes: IDW segregation by waste type, IDW container labeling, IDW container movement, IDW container storage, and IDW disposal. An IDW tracking form is included in Appendix E.

PART II: QUALITY ASSURANCE PROJECT PLAN

5.0 PROJECT MANAGEMENT

This QAPP (Part II of the SAP) supports the Bayou Verdine AOC Phase I sampling program. It was prepared in accordance with EPA QA/R-5 guidance for preparing QAPPs (EPA 1998). This section covers project management activities including the project organization, background and purpose, project description, quality objectives and criteria, special training, and documentation and records.

5.1 PROJECT ORGANIZATION

Organization and responsibilities specific to this investigation are discussed in this section and an organization chart is provided as Figure 5-1. CDM Federal will provide the necessary technical staff to perform sampling and reporting aspects of the project. CDM Federal will also procure subcontractors to provide sampling and analysis support, when necessary. Laboratory services will be provided by Quanterra, Inc. (Quanterra), the EPA Regional (Region VI) Laboratory and the EPA Region VI CLP. Other subcontractor support (e.g., boat operators) have not been confirmed. The work is being performed for EPA who has oversight responsibilities.

5.1.1 MANAGEMENT ORGANIZATION

CDM Federal is a RAC contractor to EPA. EPA management is described in Section 5.1.3. The CDM Federal Project Manager for this RI/FS including Phase I sampling is Mr. Mitch Goldberg. The Task Manager for the RI portion is Mr. Clint Werden. Mr. Werden, acting as Site Manager, will be responsible for directing field sampling activities. Ms. RoseMary Gustin is the Region VIII RAC QA Manager and is responsible for the overall QA activities associated with this project. Mr. George DeLullo is the RAC Regional QA Coordinator who will oversee project designated QA activities and Ms. Krista Lippoldt is the Denver QA Coordinator who will oversee day-to-day QA activities for this project.

Mr. Goldberg, as Project Manager, is responsible for the overall management and coordination of the following activities:

- Maintaining communications with EPA regarding the status of this project;
- Preparing weekly and monthly status reports;
- Supervising production and review of deliverables;
- Providing oversight of the subcontractors;
- Coordinating with the laboratory regarding the analytical, data validation, and QA issues related to sample analysis;
- Reviewing analytical results and deliverables from subcontractors;
- Tracking work progress against planned budgets and schedules;
- Incorporating and informing EPA of changes in the Work Plan, SAP, HASP, and/or other project documents;
- Notifying the CDM Federal Region VIII RAC QA Manager, RAC Regional QA Coordinator, or Denver QA Coordinator immediately of significant problems affecting the quality of data or the ability to meet project objectives;
- Scheduling personnel and material resources;
- Procuring subcontractors to provide sampling and analytical support;
- Implementing field aspects of the investigation, including this SAP and other project documents;
- Implementing the QC measures specified in CDM Federal's QAPP (CDM Federal 1996a) for this contract, Quality Management Plan (QMP) (CDM Federal 1996b) for this contract, this QAPP, and other project documents;
- Implementing corrective actions resulting from staff observations, QA/QC surveillances, and/or QA audits;
- Providing oversight of data management; and
- Providing oversight of report preparation.

Mr. Werden as RI Task Manager is responsible for the following:

- Organizing and conducting a field planning meeting;
- Coordinating and overseeing the efforts of the field sampling team and subcontractors providing sampling and analytical support;
- Scheduling and conducting field work;
- Notifying the subcontract analytical laboratories of scheduled sample shipments and coordinating work activities;
- Gathering sampling equipment and field logbooks and confirming required sample bottles and preservatives;
- Overseeing proper chain-of-custody and sample shipment to the analytical laboratory during sampling events;

- C Ensuring that sampling is conducted in accordance with procedures detailed in this SAP and that the quantity and location of all samples meet the requirements of the SAP; and
- C Identifying problems at the field team level, resolving difficulties in consultation with the QA staff, implementing and documenting corrective action procedures at the field team level, and providing communication between the field teams and CDM Federal management.

The roles and responsibilities of other field team members will be to assist the Task Manager with sampling activities, sample handling, and overall documentation.

5.1.2 QUALITY ASSURANCE ORGANIZATION

The QA program is implemented by CDM Federal*s Region VIII RAC QA Manager, Ms. Gustin. Ms. Gustin is independent of the technical staff and reports directly to the President of CDM Federal on QA matters. The QA Manager has the authority to objectively review projects and identify problems, and the authority to use corporate resources, as necessary, to resolve any quality-related problems.

The Denver QA Coordinator for this project, Ms. Lippoldt, and the RAC Regional QA Coordinator, Mr. DeLullo, report to Ms. Gustin on QA matters. Under Ms. Gustin*s oversight, they are responsible for the following:

- C Reviewing and approving the project-specific plans;
- C Directing the overall project QA program;
- C Maintaining QA oversight of the project;
- C Reviewing QA sections in project reports, as applicable;
- C Reviewing QA/QC procedures applicable to this project;
- C Auditing selected activities of this project performed by CDM Federal and subcontractors, as necessary;
- C Initiating, reviewing, and following-up on response actions, as necessary;
- C Maintaining awareness of active projects and their QA/QC needs;
- C Consulting with the Region VIII RAC QA Manager, as needed, on appropriate QA/QC measures and corrective actions;

- C Conducting internal system audits to check on the use of appropriate QA/QC measures, if applicable;
- C Arranging performance audits of measurement activities, as necessary; and
- C Providing monthly written reports on QA/QC activity to the Region VIII RAC QA Manager.

5.1.3 EPA MANAGEMENT

The EPA Region VIII Contracting Officer (CO), Mr. Anderson Hamp, will be responsible for overall contract management including funding and LOE budget approval and ensuring contractual obligations are met. Day-to-day management will be performed by EPA Region VI staff.

The EPA Region VI Project Officer (PO), Mr. Tom Reilly, will be responsible for:

- C Tracking Work Assignment budgets;
- C Reviewing Work Plans;
- C Providing incremental funding; and
- C Maintaining communication with the WAM and CDM Federal contract personnel.

The EPA Region VI Work Assignment Manager (WAM), Mr. John Meyer, is CDM Federal's primary contact for coordinating work at the site. He will be responsible for:

- C Reviewing all project deliverables prepared by CDM Federal;
- C Maintaining communications with CDM Federal Project Manager regarding project status;
- C Reviewing monthly status reports;
- C Providing oversight of field efforts;
- C Facilitating and maintaining communication with the stakeholders and others, where applicable;
- C Providing technical guidance to CDM Federal;
- C Tracking work progress against planned budgets and schedules;
- C Scheduling EPA personnel and material resources; and
- C Providing oversight of EPA personnel responsible for project tasks.

5.1.4 REPORT ORGANIZATION

This QAPP is organized in accordance with EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, External Review Draft Final, October 1998 (EPA 1998). Section 5.0 presents project management and introductory information. Section 6.0 provides guidance for measurement and data acquisition. Section 7.0 details assessment and oversight aspects of the project, and Section 8.0 describes data validation and usability issues. References for the entire SAP are listed in Section 9.0.

5.2 BACKGROUND AND PURPOSE

Site background information for the Bayou Verdine AOC is provided in Section 2.0 of this SAP. The purpose and objectives of the RI/FS are discussed in Section 1.1 of this SAP. The purpose of this QAPP is to provide guidance to ensure that all environmentally-related data collection procedures and measurements are scientifically sound and of known, acceptable, and documented quality and conducted in accordance with the requirements of the project.

5.3 PROJECT DESCRIPTION

The QAPP addresses field work performed during Phase I sampling for the Bayou Verdine AOC. Sediment and surface water will be sampled. These media will be analyzed for parameters listed in Section 5.4. Sampling activities and all associated procedures are described in detail in this SAP.

5.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT

This section provides internal means for control and review so that environmentally-related measurements and data collected by CDM Federal are of known quality. The subsections below describe the DQOs (Section 5.4.1) and data measurement objectives (Section 5.4.2).

5.4.1 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps based on the scientific method that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. The EPA has issued guidelines to help data users develop site-specific DQOs (EPA 1994c). The DQO process is intended to:

- Clarify the study objective;
- Define the most appropriate type of data to collect;
- Determine the most appropriate conditions from which to collect the data; and
- Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the design.

The goal of the DQO process is to "help assure that data of sufficient quality are obtained to support remedial response decisions, reduce overall costs of data sampling and analysis activities, and accelerate project planning and implementation."

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures that the resources required to generate the data are justified. The DQO process consists of seven steps of which the output from each step influences the choices that will be made later in the process. These steps include:

Step 1: State the problem;
Step 2: Identify the decision;
Step 3: Identify the inputs to the decision;
Step 4: Define the study boundaries;
Step 5: Develop a decision rule;
Step 6: Specify tolerable limits on decision errors; and
Step 7: Optimize the design.

During the first six steps of the process, the planning team develops decision performance criteria (i.e., DQOs) that will be used to develop the data collection design. The final step of the process involves optimizing the data collection design based on the DQOs. A brief discussion of these steps and their application to this project is provided below.

5.4.1.1 <u>Step 1: State the Problem</u>

The purpose of this step is to describe the problem to be studied so that the focus of the study will be unambiguous. The Bayou Verdine AOC consists of a tidally influenced, humid subtropical woodland and wetland system that both historically and currently has received discharges from both point and nonpoint sources. Bayou Verdine, as part of the Calcasieu Estuary, supports commerce, commercial fishing, and recreation for several urban areas, namely Lake Charles, Westlake, and Sulphur. Chemical manufacturing and petroleum refining activities have been present in the estuary for 80 years, since the discovery of local oil deposits.

Organic and inorganic contaminants have been documented in the sediment and surface water that suggest risk to human health and the environment. A sampling and analysis program is proposed to: (1) characterize the nature and spatial extent of organic and inorganic chemical contamination in sediment and surface water, (2) support human health and ecological risk assessment data needs and, (3) support feasibility study data needs for the Bayou Verdine AOC. However, this SAP addresses only Phase I of a three-phase characterization program.

The planning team includes Mr. John Meyer (RPM) and Mr. Jon Rauscher (Toxicologist) of the EPA (primary decision makers), Mr. Duane Wilson of the LDEQ, Mr. V. Dan Wall of FWS, Mr. Ron Gouguet of NOAA, and Mr. Mitch Goldberg and Mr. Clint Werden of CDM Federal. Resources available for this study include CDM Federal technical staff and subcontractor support staff. The budget and scope details are discussed in Work Plan Revision No. 1 dated August 1999. Major events and scheduled deliverables for this study are summarized in Table 1-1.

5.4.1.2 Step 2: Identify the Decision

This step identifies what questions this study will attempt to resolve and what actions may result. The principal study questions are divided by media and include the following:

- Are concentrations of contaminants present in the sediment above risk-based action levels?
- Are concentrations of contaminants present in the surface water above risk-based action levels?
- Have a sufficient number of samples been analyzed to adequately determine the concentrations of contaminants?

The following resolutions to the questions and possible actions have been identified:

- Individual concentration(s)/cumulative (e.g., total PCBs) concentration(s) above criteria:
    - Further Action (i.e., further investigation, remedial action, immediate response action)
    - No Further Action

- Individually/cumulatively below criteria:
    - Further Action (i.e., further investigation)
    - No Further Action

5.4.1.3 Step 3: Identify the Inputs to the Decision

The purpose of this step is to identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement. Based on the study questions of the RI/FS, the following information is required:

- Chemical concentrations in affected media i.e., (TCL VOC, TCL SVOC, TCL pesticide, TCL PCB, herbicide, TAL metals, dioxin/furan, and TPH concentrations present in sediment and surface water, where applicable); and

- C Risk-based concentrations (RBCs); i.e., values to determine whether or not contaminant concentrations pose unacceptable risk.

5.4.1.4 Step 4: Define the Boundaries of the Study

This step defines the spatial and temporal boundaries of the study. The horizontal spatial boundaries of the study are provided in Figures 2-1 and 3-1. The vertical spatial boundaries are from the air/surface water interface to the base of the sediment in Bayou Verdine. This study focuses on current conditions, but historical data has been used to develop sampling strategies. Therefore, temporal boundaries include the time frame from when potential source activities began (80 years ago) to the time of the current study (1999-2000). The data used for decision-making, however, will be from the most recent sampling event (October 1999 through January 2000), although the existing contaminants may have been deposited at any time since the beginning of potential source activities. The data populations needed for decision-making for this study include the chemical concentrations (including both detected and nondetected values) for all the media sampled and analyzed. Constraints that could potentially interfere with data collection are unaccessible sampling locations. However, alternative locations have been established to minimize problems associated with unaccessable sample locations (Table 3-1).

5.4.1.5 Step 5: Develop a Decision Rule

The purpose of this step is to define the parameters of interest, specify the action levels, and integrate previous DQO outputs into a single statement that describes a logical basis for choosing among alternative actions. The parameters of interest are the concentrations and locations of constituents identified in the separate media that pose significant adverse risk. Measured concentrations should estimate the true values of the constituents at a specific location and may be used on an individual (e.g., pyrene) or cumulatively (e.g., total polycyclic aromatic hydrocarbons) basis. The action levels will be developed using RBCs as inputs.

5.4.1.6 <u>Step 6: Specify Tolerable Limits on Decision Errors</u>

Decision maker's tolerable limits on decision errors, which are used to establish performance goals for the data collection design, are specified in this step. Decision makers are interested in knowing the true value of the constituent concentrations. Since analytical data can only estimate these values, decisions that are based on measurement data could be in error (decision error). There are two reasons why the decision maker may not know the true value of the constituent concentration, these are:

(1) Concentrations may vary over time and space. Limited sampling may miss some features of this natural variation because it is usually impossible or impractical to measure every point of a population. *Sampling design error* occurs when the sampling design is unable to capture the complete extent of natural variability that exists in the true state of the environment.

(2) Analytical methods and instruments are never absolutely perfect, hence a measurement can only estimate the true value of an environmental sample. *Measurement error* refers to a combination of random and systematic errors that inevitably arise during the various steps to the measurement process.

The combination of sampling design and measurement error is the total study error. Since it is impossible to completely eliminate total study error, basing decisions on sample concentrations may lead to a decision error. The probability of decision error is controlled by adopting a scientific approach in which the data are used to select between one condition (the null hypothesis) and another (the alternative hypothesis). The null hypothesis is presumed to be true in the absence of evidence to the contrary. For this project the null hypothesis is that the true values of the constituents are below the action levels. The alternative hypothesis is that the true values of the constituents are above the action levels.

An example of decision errors and tolerable limits are presented in graphical form in Figure 5-2. A false positive or "Type I" decision error refers to the type of error made when the null hypothesis is rejected when it is true and a false negative or "Type II" decision error refers to the type of error made when the null hypothesis is accepted when it is false. For this project, a Type

I decision error would result in deciding that the site was contaminated above action levels ("dirty") when it is not and a Type II decision error would result in deciding that the site was not contaminated above action levels ("clean") when it is. For example, if the action level for a constituent is 2,300 milligrams per kilogram (mg/kg), the reported concentration is 2,200 mg/kg, and the true value is 2,400 mg/kg, a Type II error could easily be made by not applying any decision error limits. For this project, a Type II error is less acceptable (worse case) than a Type I error because a Type II error could result in ecological and/or human harm whereas, a Type I error could result in spending additional funding for further investigating a "clean" site.

The closer the reported concentration is to the action level, the higher the probability that an incorrect decision will be made and, therefore, there is a "gray region" surrounding the action level. For this project, there is no "gray area" and the tolerable decision error is ± 10 percent. A graphical representation of this is provided in Figure 5-2.

5.4.1.7 <u>Step 7: Optimize the Design for Obtaining Data</u>

This step identifies a resource-effective data collection design for generating data that are expected to satisfy the DQOs. The data collection design (sampling program) is described in detail in Section 3.0. It was developed based on historical data, communication with knowledgeable people familiar with the site, and a site visit. In addition, the entire characterization program is phased, with this project being Phase I.

5.4.2 DATA MEASUREMENT OBJECTIVES

All sediment and surface water samples will be analyzed for total TAL metals, VOCs, SVOCs, pesticides, PCBs, herbicides, and TPH. Surface water samples will also be analyzed for dissolved TAL metals. Twenty percent of all samples will be analyzed for dioxins/furans.

Twenty percent of the sediment samples will be analyzed for ancillary sediment parameters and 20 percent of the surface water samples will be analyzed for ancillary surface water parameters.

Ancillary sediment parameters include particle size, pH, Eh, CEC, TPHs, and TOC. Ancillary surface water parameters include major anions (i.e., bromide, chloride, fluoride, nitrate/nitrite, ortho-phosphate, and sulfate), ammonia, TDS, TSS, BOD, COD, TOC, TPHs, hardness, and alkalinity. Sediment and surface water may also be analyzed for several other field measurements, as described in Section 4.0.

Every reasonable attempt will be made to obtain a complete set of usable field measurements and analytical data. If a measurement cannot be obtained or is unusable for any reason, the effect of the missing data will be evaluated by the CDM Federal Project Manager and CDM Federal QA staff. This evaluation will be reported to EPA with a proposed corrective action.

5.4.2.1 Quality Assurance Guidance

The field QA program has been designed in accordance with CDM Federal*s RAC VIII QAPP (CDM Federal 1996a), the QMP for this contract (CDM Federal 1996b), EPA*s Guidance for the Data Quality Objectives Process (EPA 1994c), and the EPA*s Requirements for Quality Assurance Project Plans for Environmental Data Operations, QA/R-5 (EPA 1998).

5.4.2.2 Precision, Accuracy, Representativeness, Completeness, and Comparability Criteria

Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are indicators of data quality. PARCC goals are established for the site characterization to aid in assessing data quality. All data evaluations will be in accordance with the criteria presented in Table 5-1. The following paragraphs define these PARCC parameters in conjunction with this project.

Precision. The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision is quantitative and most often expressed in terms of relative percent difference (RPD). Precision of the laboratory analyses will be assessed by comparing original and duplicate results, where applicable. The RPD will be calculated for each pair of applicable duplicate analyses using the following equation:

*RelativePercentDifference ' *S&D*/((S%D)/2)×100*

Where	S	=	First sample value (original value); and
	D	=	Second sample value (duplicate value).

Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability depending on the type of QC sample. Data may be evaluated for precision using the following types of samples (in order of priority): field duplicates, laboratory duplicates, laboratory control sample/laboratory control sample duplicates (LCS/LCSDs), or MS/MSDs, whichever are analyzed and specified by Table 5-1.

The acceptable RPD limits for duplicate measurements are listed in Table 5-1 and are in accordance with the laboratory-specific limits, methodology, EPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review (EPA 1994a), or EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA 1994b), whichever are applicable.

Accuracy. Accuracy is the degree of agreement of a measurement with an accepted reference or true value and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the percent recovery (%R) of a sample result. %R is calculated as follows:

Percent Recovery = SSR - SR / SA x 100

Where:	SSR	=	Spiked Sample Result
	SR	=	Sample Result
	SA	=	Spike Added

Ideally, it is desirable that the reported concentration equals the actual concentration present in the sample. Data may be evaluated for accuracy using (in order of priority) either LCS/LCSDs, MS/MSDs, and/or surrogates, as specified by Table 5-1. The acceptable %R limits are presented in Table 5-1 and are in accordance with the laboratory-specific limits, methodology, EPA National Functional Guidelines for Inorganic Data Review (EPA 1994a), or EPA National Functional Guidelines for Organic Data Review (EPA 1994b), whichever are applicable.

Representativeness. Representativeness expresses the degree to which sample data accurately and precisely represent:

C the characteristic being measured,
C parameter variations at a sampling point, and/or
C an environmental condition.

Representativeness is a qualitative and quantitative parameter that is most concerned with the proper sampling design and the absence of cross-contamination of samples. Acceptable representativeness will be achieved through (a) careful, informed selection of sampling sites, (b) selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits, (c) proper gathering and handling of samples to avoid interferences and prevent contamination and loss, and (d) collection of a sufficient number of samples to allow characterization. The representativeness will be assessed qualitatively by reviewing the sampling and analytical procedures and quantitatively by reviewing the blank samples. If an analyte is detected in a method, preparation, or rinsate blank, any associated positive result less than five times (10 times for common laboratory contaminants) may be considered a false positive as specified in Table 5-1. Holding times will also be evaluated to determine if analytical results may be representative of sample concentrations.

Completeness. Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the PARCC parameters excluding completeness. Those data that are validated or evaluated and are not considered estimated or are qualified as estimated or nondetect are considered usable. Rejected data are not considered usable. A completeness goal of 90 percent is projected. If this goal is not met, the effect of not meeting this goal will be discussed by the CDM Federal Project Manager and the EPA RPM. Completeness is calculated using the following equation:

$$\%\ Completeness = (DO{}^{*}DP)x100$$

Where: DO = Data Obtained and usable.
DP = Data Planned to be obtained.

Comparability. Comparability is a qualitative parameter. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Data developed under this investigation will be collected and analyzed using standard EPA analytical methods and QC to ensure comparability of results with other analyses performed in a similar manner.

Sensitivity. Sensitivity, although not a PARCC parameter, will be evaluated for this project. The achievement of method detection limits depends on instrument sensitivity and sample matrix effects. Therefore, it is important to monitor the sensitivity of data-gathering instruments to ensure the data quality through constant instrument performance. Instrument sensitivity will be monitored through the analysis of blanks. To minimize the affects of interferences, the laboratory may modify the extraction and/or analytical methods and/or fine-tune the instruments. Any modifications will be documented by the laboratory and reported in the RI Report.

5.4.2.3 <u>Field Measurements</u>

The only field measurements collected during this investigation will be water quality parameters, including pH, temperature, conductivity, turbidity, DO, Eh, and salinity, sediment Eh, and VOC screening for health and safety purposes.

5.4.2.4 Laboratory Analysis

Analytical methods, reporting limits, holding times and preservatives, and QC analyses are discussed below.

Analytical Methods

All analyses and methods are listed in Table 5-1. Tables 3-2 and 3-3 present the analyses for each type of sample. Volume requirements are presented in Table 5-2.

Sediment samples (including duplicate samples) collected under this SAP will be analyzed for all of the following:

- Total TAL metals (including cyanide) using EPA CLP Statement of Work for Inorganics Analysis, Multi-media Multi-concentration ILM 04.0 (ILM 04.0)(EPA 1997b);
- Arsenic (As) using Test Methods For Evaluating Solid Waste: Physical/Chemical Methods with Revisions (EPA 1997) SW-846 Method 7060A;
- TCL VOCs using EPA CLP Statement of Work for Organics Analysis, Multi-media Multi-concentration OLM 04.2 (OLM 04.2) (EPA 1999);
- TCL SVOCs using OLM 04.2;
- TCL Pesticides using OLM 04.2;
- TCL PCBs using OLM 04.2; and
- Herbicides using SW-846 Method 8150A.

Surface water samples (including duplicate samples) collected under this SAP will be analyzed for all of the following:

- C Total and dissolved TAL metals using SW-846 Methods 6010B, 7060A (As), 7211 (copper [Cu]), 7421 (lead [Pb]), 7470A (mercury [Hg]), and 9010B (cyanide [CN]);
- C TCL VOCs using EPA CLP Statement of Work for Organics Analysis, Low Concentration Water OLC 02.1 (OLC 02.1) (EPA 1996);
- C TCL SVOCs using OLC 02.1;
- C TCL Pesticides using OLC 02.;
- C TCL PCBs using OLC 02.1; and
- C Herbicides using SW-846 Method 8150A.

Twenty percent of the total samples will be analyzed for the following:

- C Dioxins/Furans using SW-846 Method 8290 and
- C TPHs using SW-846 Method 8015 modified.

Twenty percent of the sediment samples will be analyzed for the following:

- C Particle size using ASTM Method D422;
- C pH using SW-846 Method 9045B;
- C CEC using SW-846 Method 9081; and
- C TOC using modified SW-846 Method 9060A.

Twenty percent of the surface water samples will be analyzed for the following:

- C Major anions (bromide, chloride, fluoride, nitrate/nitrite, ortho-phosphorate, and sulfate) using EPA Method 300.0;
- C TKN using EPA Method 351.3 - Potentiometric;
- C Ammonia using EPA Method 350.2;
- C TDS using EPA Method 160.1;
- C TSS using EPA Method 160.2;
- C BOD using EPA Method 405.1;
- C COD using EPA Method 410.1;
- C Hardness using EPA Method 130.2;
- C TOC using SW-846 Method 9060A; and
- C Alkalinity using EPA Method 310.1.

Equipment rinsate blank samples collected under this SAP will be analyzed for all of the following:

- Total TAL metals (including cyanide) ILM 04.0;
- TCL VOCs using OLC 02.1;
- TCL SVOCs using OLC 02.1;
- TCL Pesticides using OLC 02.1;
- TCL PCBs using OLC 02.1;
- Herbicides using SW-846 Method 8150A.

Twenty percent of the equipment rinsate blank samples will be analyzed for the following:

- Dioxins/Furans using SW-846 Method 8290 and
- TPHs using SW-846 Method 8015 modified.

Trip blank samples will be analyzed for the following:

- TCL VOCs using OLC 02.1.

Laboratories

Quanterra, EPA Regional (Region VI), EPA Region VI CLP are the laboratories responsible for chemical analyses of the samples:

Quanterra Incorporated
Attention: Sample Custodian
4955 Yarrow Street
Arvada, Colorado 80002
(303)421-6611
(303)431-7171 (fax)

EPA Regional Laboratory
EPA region VI
Attention: Sample Custodian
10625 Fallstone Road
Houston, Texas 77099-4303
(281) 983-2100
(281) 983-2248

Contract Laboratory Program
EPA Region VI
Attention: Sample Custodian
To Be Determined

Reporting Limits

The reporting limits provided in Table 5-3 are the minimum levels that the laboratory will report analytical results without a qualifier when an analyte is detected. The laboratory can typically detect analytes at concentrations of up to an order of magnitude lower than the reporting limits; in this case, when a positive detection is less than the reporting limit, the value may be reported and qualified as an estimated concentration. To minimize the affects of interferences, the laboratory may modify the extraction and/or analytical methods and/or readjust the instruments. Any modifications will be documented by the laboratory and reported in the RI Report.

Holding Times and Preservatives

Holding times are storage times allowed between sample collection and sample extraction or analysis (depending on whether the holding time is an extraction or analytical holding time) when the designated preservation and storage techniques are employed. Holding times for each analytical method are provided in Table 5-1 and preservatives for each sample aliquot are listed in Table 5-2.

Quality Control Analyses

To provide an external check of the quality of the field procedures and laboratory analyses, three types of QC samples (duplicate samples, equipment rinsate blanks, and trip blanks) will be collected and analyzed. Triple volume will also be collected at a rate of 5 percent for MS/MSD analyses. Blank samples will be analyzed to check for cross-contamination during sample shipment (trip) and/or equipment decontamination (rinsate). Duplicate samples will provide a check for sampling and analytical error. The samples that will be analyzed for QC are discussed in Section 6.5.1.

In addition to the external QA/QC controls, internal QC procedures are maintained by the laboratory. Internal QC samples will include laboratory blanks (i.e., method blanks, preparation blanks), laboratory duplicates, MS/MSDs, and LCS/LCSDs, as discussed in Section 5.4.2.2.

5.5 SPECIAL TRAINING REQUIREMENTS

Special training required for this investigation will be the health and safety training, as described in the HASP (Appendix B). In addition, EPA Region 6 Regional Sample Control Coordinator, Ms. Myra Perez conducted training on CLP sampling and Data Package Review (Appendix F).

5.6 DOCUMENTATION AND RECORDS

The laboratories will submit analytical data reports to CDM Federal. Each data report will contain a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed chain-of-custody forms, cooler receipt forms, analytical data, a QC package, and raw data. An electronic copy of the data will also be provided by the laboratories to CDM Federal. This electronic copy is detailed in the subcontract with each laboratory.

Project records, including reports, field data, analytical data, audit reports, and any other records applicable to the project will be maintained in the project file. The official project record will be maintained in CDM Federal's Golden, Colorado office. Copies of all project documentation generated by CDM Federal will be transmitted to the EPA Region VI Administrative Record.

6.0 MEASUREMENT AND DATA ACQUISITION

This section addresses sample process design, sampling methods requirements, handling and custody, analytical methods, QC, equipment maintenance, instrument calibration, supply acceptance, nondirect measurements, and data management. CLP requirements are summarized in Appendix F.

6.1 <u>SAMPLE PROCESS DESIGN</u>

The goal of the field investigation is to verify and quantify the presence or absence of contamination in the sampling media. The number, types, locations, and analyses of samples are presented in Tables 3-2, 3-3, and 3-4 and Section 3.0.

6.2 <u>SAMPLING METHODS REQUIREMENTS</u>

Sampling equipment and preparation, sample containers and preservatives, and sample collection, handling, and shipment are described below.

6.2.1 SAMPLING EQUIPMENT AND PREPARATION

Sampling equipment required for the field program for environmental monitoring, sampling, health and safety monitoring, equipment and personal decontamination, and general field operations are presented in Table 4-2.

Field preparatory activities include review of SOPs, procurement of field equipment, laboratory coordination, confirmation of site access, as well as a field planning meeting attended by field personnel and QA staff. Site setup is described in Section 4.0.

6.2.2 SAMPLE CONTAINERS AND PRESERVATIVES

Sample containers and preservatives required for the solid and aqueous samples are presented in Tables 3-2 and 5-2. Preservatives will be added to the sample containers by the laboratory when possible. Preservatives will be onsite in the event that a sample container needs to be preserved in the field. Containers and applicable preservatives will be supplied by Quanterra for the samples being sent to Quanterra and by CDM Federal for the samples sent to the EPA Region VI CLP laboratory.

6.2.3 SAMPLE COLLECTION, HANDLING, AND SHIPMENT

Samples collected during this field program consist of sediment, surface water, IDW, and QC samples. All sample collection procedures are outlined in the FSP (Part I of this SAP) and/or CDM Federal*s Technical Standard Operating Procedures Manual (CDM Federal 1999). The following SOPs (provided in Appendix C) apply to all applicable procedures unless otherwise noted in the FSP:

<u>CDM Federal SOPs</u>:

- SOP 1-1, Surface Water and Sediment Sludge Sampling;
- SOP 1-2, Sample Custody;
- SOP 1-10, Field Measurement of Organic Vapors;
- SOP 2-5, Packaging and Shipping of Environmental Samples;
- SOP 2-6, Guide to Handling of Investigation-Derived Waste;
- SOP 3-5, Lithologic Logging;
- SOP 4-1, Field Logbook Content and Control;
- SOP 4-2, Photographic Documentation of Field Activities (with site-specific modification);
- SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites; and
- SOP 5-1, Control of Measurement and Test Equipment.

6.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Custody and documentation for field and laboratory work are described below, followed by a discussion of corrections to documentation.

6.3.1 FIELD SAMPLE CUSTODY AND DOCUMENTATION

The information contained on the sample label and the chain-of-custody record must match. The purpose and description of the sample label and the chain-of-custody record are discussed in the following sections.

6.3.1.1 Sample Labeling and Identification

An alpha-numeric coding system will be used to uniquely identify each sample collected during the field investigation (as specified in SOP 1-2, Sample Custody).

Sample numbers will begin with the year, site abbreviation, and phase number (e.g., "99BV1" indicates that the sample was collected in 1999, at the Bayou Verdine AOC during Phase 1). For all samples, except trip blanks, the following paragraphs apply. The second character set in the sample identification will indicate the location of the sample and will include the two-digit reach number followed by the three-digit sample number and then a letter (i.e., "#####X"). The letter will correspond to the number of locations at this reach/sample location (i.e., "A" will stand for the first location at that specific reach/sample, "B" will represent the second location, etc.), if additional locations are necessary. The third character set represents the type and media of the sample (i.e., "XXX"). Types of samples will include the following:

N	=	Normal
D	=	Duplicate
R	=	Rinsate

Media codes will include the following:

SD	=	Sediment
SW	=	Surface Water
ID	=	IDW Water

The final set of numbers (i.e., “###”) for sediment and surface water represents the ending depth interval rounded to the nearest foot (e.g., the 0 to 15-cm samples will end in “015"). The following are examples of sample identification codes:

99BV1- R2001A-NSD-015

99BV1	=	1999, Bayou Verdine, Phase 1
R2001A	=	Reach Number 2, Sample Location 001, First Location at R2001
N	=	Normal (non-QC) Sample
SD	=	Sediment
015	=	Depth Interval (ending depth is 15 cm into sediment)

99BV1- R2001A-DSW-015

99BV1	=	1999, Bayou Verdine, Phase 1
R2001A	=	Reach Number 2, Sample Location 001, First Location at R2001
D	=	Duplicate Sample
SW	=	Surface Water
015	=	Depth Interval (15 cm deep in surface water [upper one-third])

99BV1- R2001A-RSD-001

99BV1	=	1999, Bayou Verdine, Phase 1
R2001A	=	Reach Number 2, Sample Location 001, First Location at R2001
R	=	Rinsate Sample
SD	=	Collected for Sediment Samples
015	=	Depth Interval of Original Sample (ending depth is 15 cm into sediment)

Trip blanks will be identified using the year, site abbreviation, and phase number (i.e., "99BV1") and the shipping date followed by an A (i.e., MMDDYYA). The third set of numbers will indicate that it is a trip blank (i.e., "TBK"). A final set of numbers (i.e., ###) will represent the sequential number of trip blank shipped on that date. A record will be kept which identifies which samples are associated with each trip blank. The following is an example:

99BV1-102799A03

99BV1	=	1999, Bayou Verdine, Phase 1
102799A	=	Trip Blank was shipped on November 22, 1999
TBK	=	Trip Blank Sample
003	=	Third Trip Blank shipped on November 22, 1999

Labels will be used in accordance with SOP 1-2, Sample Custody (Appendix C).

A number of samples will be submitted to EPA Region VI CLP. Sample labeling (i.e. sample numbers and sample tags) will conform to the requirements of Region VI CLP (Appendix F).

6.3.1.2 Chain-of-Custody Requirements

Chain-of-custody procedures will follow the requirements set forth in CDM Federal*s SOP 1-2, Sample Custody (Appendix C). The chain-of-custody record is employed as physical evidence of sample custody and control. This record system provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting.

A number of samples will be submitted to EPA Region VI CLP. Chain-of-custody and traffic reports will conform to the requirements of Region VI CLP (Appendix F).

6.3.1.3 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with SOP 2-5, Packaging and Shipping of Environmental Samples (Appendix C) and/or the EPA Region VI CLP requirements (Appendix F), as appropriate.

6.3.1.4 Field Logbook(s) and Records

Field logbook(s) will be maintained by the field team in accordance with SOP 4-1, Field Logbook Content and Control (Appendix C). The RI Task Manager is responsible for maintenance and document control of the field logbooks. Field logbook entries will be photocopied weekly and entered in the project files.

All sediment samples will be logged in accordance with SOP 3-5, Lithologic Logging. It should be noted that most of the sediment samples will be collected from the 0 to 6-inch depth interval. However, pertinent information will be recorded on a borehole log form (Appendix E).

6.3.1.5 Photographs

Field teams may photograph appropriate field work activities for documentation purposes. Photographs will be documented in accordance with SOP 4-2, Photographic Documentation of Field Activities with modification. Modification to this SOP has been requested and approved and is included in Appendix C.

6.3.2 LABORATORY CUSTODY PROCEDURES AND DOCUMENTATION

Laboratory custody procedures are provided in each laboratories' QA Manual. Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping cooler and the individual samples. This inspection will include measuring the temperature of the cooler (if chilling is required) to document that the temperature of the samples is within the acceptable criteria (4 ± 2 degrees Celsius [EC]) and verifying sample integrity. The pH of the samples will be measured, if preserved with an acid or a base. The enclosed chain-of-custody records will be cross-referenced with all of the samples in the shipment. These chain-of-custody records will then be signed by laboratory personnel. Copies provided to CDM Federal will be placed in the project files. The sample custodian may continue the chain-of-custody record process by assigning a unique laboratory number to each sample on receipt. This number, if assigned, will identify the sample through all further laboratory handling. It is the laboratory*s responsibility to maintain internal logbooks and records throughout sample preparation, analysis, data reporting, and disposal.

6.3.3 CORRECTIONS TO AND DEVIATIONS FROM DOCUMENTATION

Logbook modification requirements are described in SOP 4-1, Field Logbook Content and Control (Appendix C). For the logbooks, a single strikeout initialed and dated is required for documentation changes. The correct information should be entered in close proximity to the erroneous entry. All deviations from the guiding documents will be recorded in the logbook(s). Any major deviations will be documented according to the QMP (CDM Federal 1996b).

6.4 ANALYTICAL METHODS REQUIREMENTS

The laboratory QA program and analytical methods are addressed below.

6.4.1 LABORATORY QUALITY ASSURANCE PROGRAM

Samples collected during this project will be analyzed in accordance with standard EPA and/or nationally-accepted analytical procedures. Quanterra and the EPA Region VI CLP laboratories will adhere to all applicable QC requirements established by the subcontract and applicable analytical methods.

6.4.2 METHODS

The methods to be used for chemical analysis are discussed in Section 5.4.2.4. The holding time requirements for each analytical method are provided in Table 5-2.

6.5 QUALITY CONTROL REQUIREMENTS

Field, laboratory, and internal office QC are discussed below.

6.5.1 FIELD QUALITY CONTROL SAMPLES

The following types of QC samples will be collected in the field and shipped to the appropriate subcontractor or Region VI CLP laboratory for analysis:

- Field duplicates;
- Equipment rinsate blanks; and
- Trip blanks.

These types of QC samples are discussed below.

6.5.1.1 Field Duplicates

Field duplicates for both sediment and surface water samples will be collected at a single sampling location, collected identically and consecutively over a minimum period of time. This type of field duplicate measures the total system variability (field and laboratory variance), including the variability component resulting from the inherent heterogeneity of the sediment (for sediment samples). Field duplicates will be collected at a minimum frequency of one per 10 samples per media (10 percent) (Table 3-3).

6.5.1.2 Equipment Rinsate Blanks

An equipment rinsate blank will be prepared and submitted for analysis at a minimum frequency of one per 20 samples per media (5 percent) if equipment is decontaminated between sampling locations (Table 3-3). These blanks consist of analyte-free water collected by containing the sampling equipment rinse water after equipment decontamination for both sediment and surface water samples.

6.5.1.3 Trip Blanks

A trip blank consists of analyte-free water provided by the laboratory or deionized water used by sampling personnel for equipment decontamination prior to decontamination. It accompanies the samples throughout the shipment process. This QC sample serves as a check for cross-contamination of VOCs during shipment to and from the laboratory. Once filled, trip blanks must not be opened. Trip blanks will be prepared and submitted to the laboratories at a frequency of one per cooler when sediment or surface water samples are shipped for VOC analysis (Table 3-3).

6.5.2 LABORATORY QUALITY CONTROL SAMPLES

Quanterra and EPA Region VI Regional and CLP laboratories will follow all laboratory QC checks, as defined in the analytical methods listed in Section 5.4.2.2 or the CLP SOW. QC samples are necessary to determine laboratory precision and accuracy and to demonstrate the absence of interferences and/or contamination. Each type of laboratory-based QC will be analyzed at a rate of 5 percent of normal samples submitted or one per batch (a batch is a group of up to 20 samples analyzed together), whichever is more frequent. Results of laboratory QC samples will be included in the laboratory data package. Laboratory QC samples may consist of method blanks, laboratory duplicates, MS/MSDs, LCS/LCSDs, and/or performance evaluation samples whichever are applicable, and any other method-required QC samples. Each is briefly described in the following paragraphs.

Method blank samples will be analyzed to assess possible internal laboratory contamination. If contamination is found, the laboratory can quickly initiate corrective measures to eliminate the contamination.

Laboratory duplicate samples are aliquots of a single sample that are split on arrival at the laboratory or upon analysis. Results obtained for two replicates that are split in a controlled laboratory environment may be used to assess laboratory precision of the analysis.

Finally, the laboratory will conduct either and/or both MS/MSD and LCS/LCSD analyses to determine laboratory precision and accuracy.

For organic analyses of sediment and surface water samples, surrogates may be used to evaluate accuracy. Both normal and QC samples will be spiked with surrogate compounds, when applicable, and a %R will be calculated for each surrogate.

6.5.3 INTERNAL QUALITY CONTROL CHECKS

Internal QC checks will be conducted throughout the project to evaluate the performance of the project team during data generation. All internal QC will be conducted in accordance with applicable methodologies listed in Table 5-1.

All project deliverables will receive technical and QA reviews prior to being issued to EPA, as required. These reviews will be conducted in accordance with CDM Federal's Quality Procedure (QP) 3.2, Technical Document Review and QP 3.3, Quality Assurance Review (CDM Federal 1997a). Completed review forms will be maintained in the project and working files.

6.6 EQUIPMENT MAINTENANCE PROCEDURES

All laboratory equipment will be maintained in accordance with each laboratory*s SOPs.

6.7 INSTRUMENT CALIBRATION PROCEDURES AND FREQUENCY

Calibration of field and laboratory instruments is addressed in the following subsections.

6.7.1 FIELD INSTRUMENT AND EQUIPMENT CALIBRATION

Field instruments and equipment will be used to obtain water pH, temperature, conductivity, turbidity, DO, Eh, and salinity measurements, sediment Eh, and air VOC concentrations for health and safety screening purposes. Field instruments and equipment will be calibrated prior to use each day following manufacturer*s instructions. Calibration information will be recorded on calibration forms (Appendix E).

6.7.2 LABORATORY EQUIPMENT CALIBRATION

Calibration of laboratory equipment will be based on written procedures approved by laboratory management. Instruments and equipment will be initially calibrated and subsequently continuously calibrated at approved intervals, as specified by either the manufacturer or more updated requirements (e.g., methodology requirements). Calibration standards used as reference standards will be traceable to the EPA, National Institute of Standards and Technology, or another nationally-recognized reference standard source.

Records of initial calibration, continuing calibration and verification, repair, and replacement will be filed and maintained by each laboratory. Calibration records will be filed and maintained at the laboratory location where the work is performed and may be required to be included in data reporting packages.

6.8 ACCEPTANCE REQUIREMENTS FOR SUPPLIES

Prior to acceptance, all supplies and consumables will be inspected and documented to ensure that they are in satisfactory condition and free of defects.

6.9 NONDIRECT MEASUREMENT DATA ACQUISITION REQUIREMENTS

Nondirect measurement data include information from site reconnaissances, literature searches, and interviews. The acceptance criteria for such data include a review by someone other than the author. Any measurement data included in information obtained from the above-referenced sources will determine further action at the Bayou Verdine AOC only to the extent that those data can be verified.

6.10 DATA MANAGEMENT

Sample results and QC data will be delivered to CDM Federal as an electronic data deliverable (EDD) in addition to a hard-copied data package. Electronic copies of all project deliverables, including graphics, are maintained by project number. Electronic files are routinely backed up and archived. The Final SAP and RI Report will be submitted to EPA on 3.5-inch diskettes or CD-Rom in WordPerfect 6.0/6.1 and MS Access 97 or MS Excel 97 (and any other applicable software such as AutoCADD, ARCView, or ARCInfo), if requested. Map files will be graphic files only because of the large sizes of ARCInfo files.

CDM Federal*s local administrative staff has the responsibility for maintaining the document control system. This system includes a document inventory procedure and a filing system. Project personnel are responsible for project documents in their possession while working on a particular task. Data management protocol and procedures are discussed in the Section 8.0.

7.0 ASSESSMENT AND OVERSIGHT

Assessments and oversight reports to management are discussed below.

7.1 ASSESSMENTS AND RESPONSE ACTIONS

Performance assessments are quantitative checks on the quality of a measurement system and may be used for analytical work. System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and the functioning of the QA system. A field and an office system assessment is currently scheduled for this project.

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the field logbook and verbally reported to the CDM Federal Project Manager. Major response actions taken in the field will be approved by the CDM Federal Project Manager and an EPA RPM prior to implementation of the change. Corrective action will be implemented in accordance with CDM Federal's Quality Procedure 8.1 Corrective Action (CDM Federal 1997b). A copy of the Corrective Action Request Form is included in Appendix E.

7.2 REPORTS TO MANAGEMENT

QA reports will be provided to management whenever major quality problems are encountered. Field staff will note any quality problems in a logbook or other form of documentation. CDM Federal's Project Manager will inform the QA Coordinator upon encountering quality issues that cannot be immediately corrected. Monthly QA reports will be submitted to CDM Federal*s RAC Region VIII QA Manager by the Denver QA Coordinator and the RAC Regional QA Coordinator.

Topics to be summarized regularly may include:

- Activities and general program status;
- Project meetings;
- Corrective action activities;
- Any unresolved problem; and
- Any significant QA/QC problems not included above.

8.0 DATA VALIDATION AND USABILITY

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 8.1 and 8.2, respectively.

8.1 VALIDATION AND VERIFICATION METHODS

One hundred percent of the data analyzed and reported by CDM Federal's subcontract laboratory, Quanterra, will be validated in accordance with laboratory-specific limits, methodology, EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 1994a), and/or EPA CLP National Functional Guidelines for Organic Data Review (EPA 1994b), whichever are applicable and as specified in Table 5-1. Data from EPA's Region VI Regional and CLP laboratories will be 100 percent validated prior to receipt by CDM Federal.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. During data validation, analytical data may be qualified as specified in the above-referenced guidances.

8.2 RECONCILIATION WITH USER REQUIREMENTS

8.2.1 DATA EVALUATION

One hundred percent of the analytical data from all laboratories will be evaluated for compliance with PARCC parameter criteria as described in Section 5.0 and specified in Table 5-1. After validation and evaluation, it will be determined by CDM Federal if and which data are usable for their intended purposes. During data evaluation, analytical data will not be qualified.

8.2.2 DATA REDUCTION AND TABULATION

Sample data will be maintained electronically by CDM Federal and reported in the RI Report.

9.0 REFERENCES

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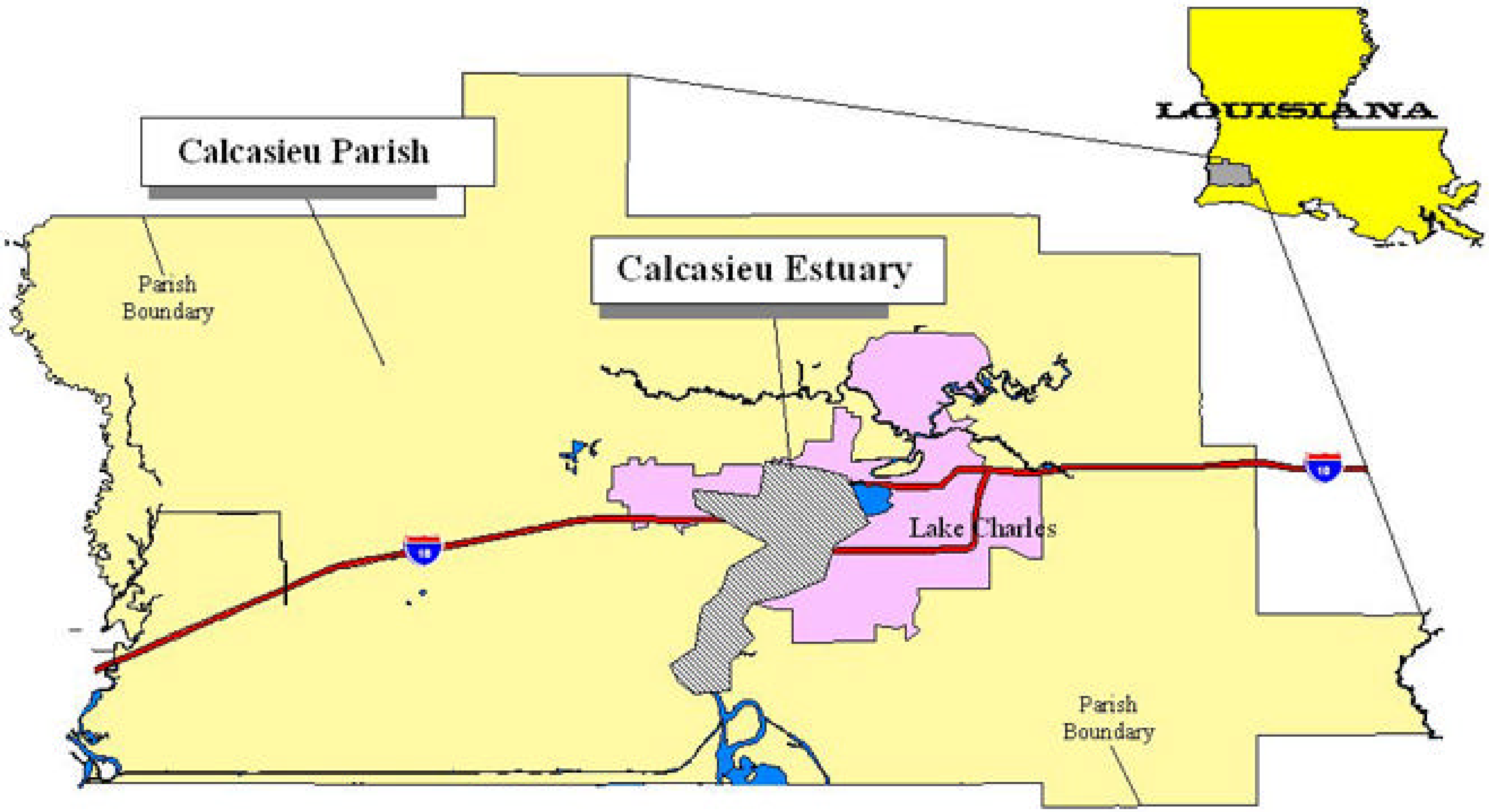
FIGURES



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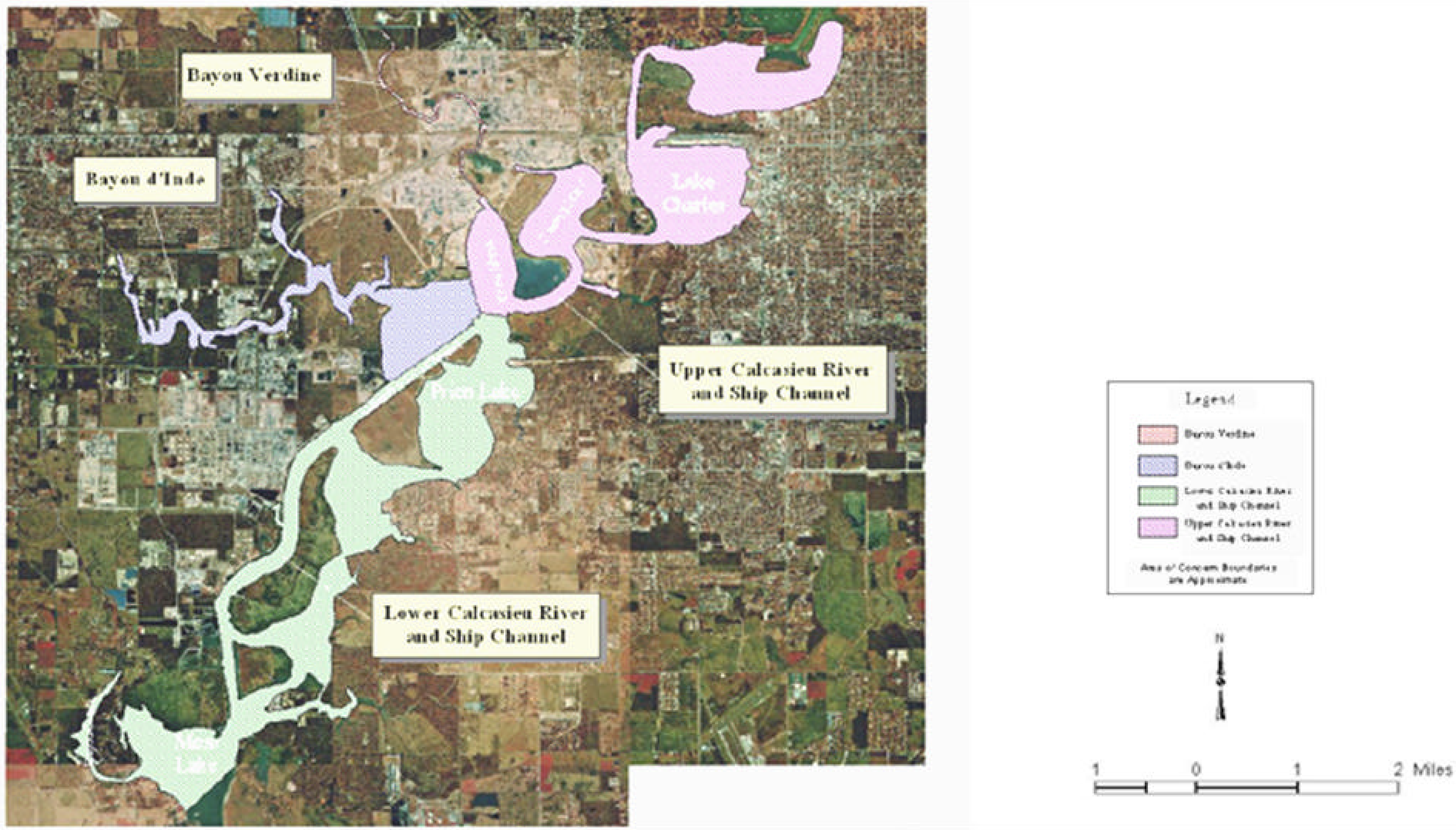
Site Location Map
Calcasieu Estuary

CALCASIEU PARISH, LOUISIANA

Figure 1-1



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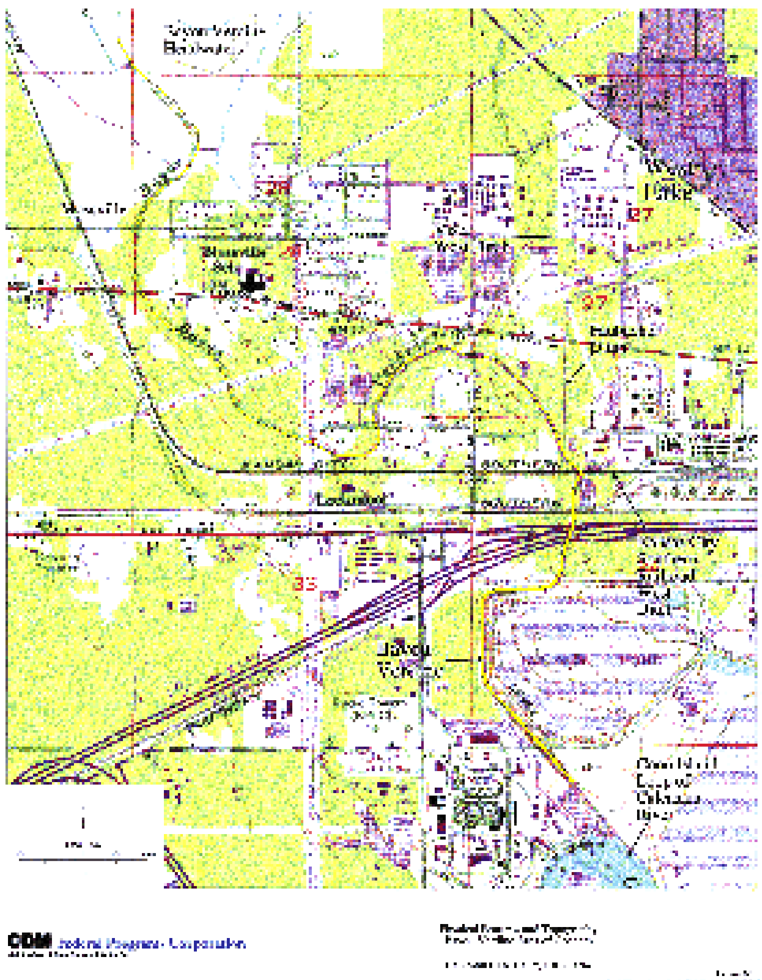
Areas of Concern
Calcasieu Estuary

CALCASIEU PARISH, LOUISIANA

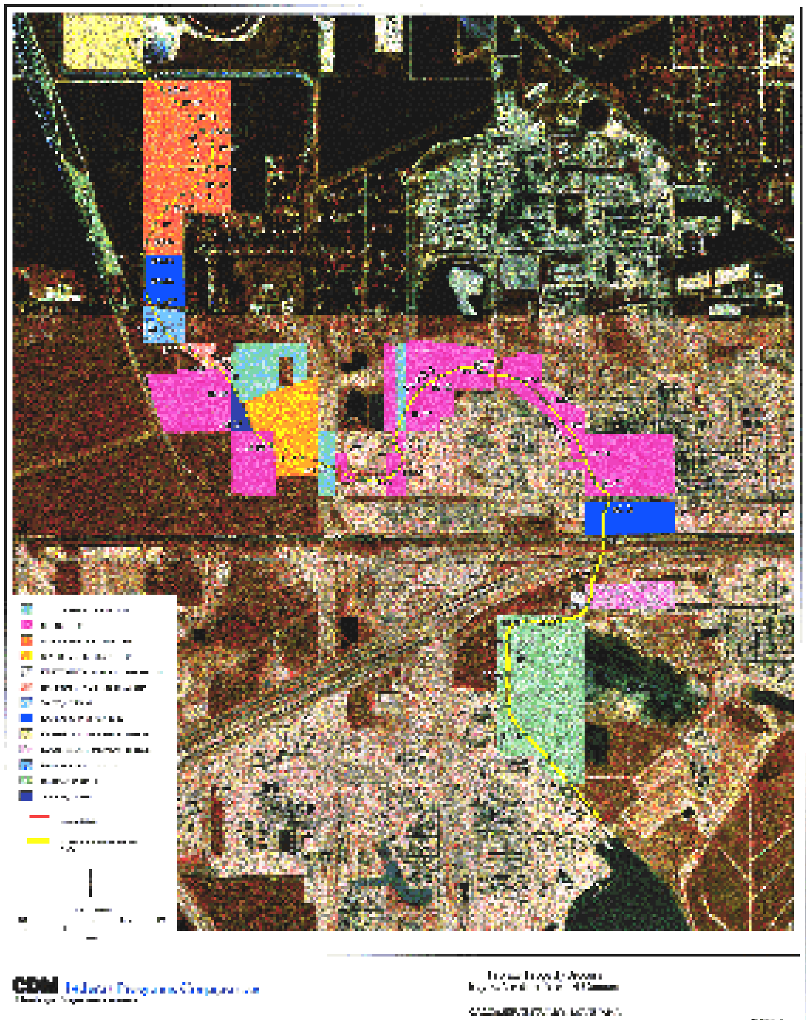
Figure 1-2

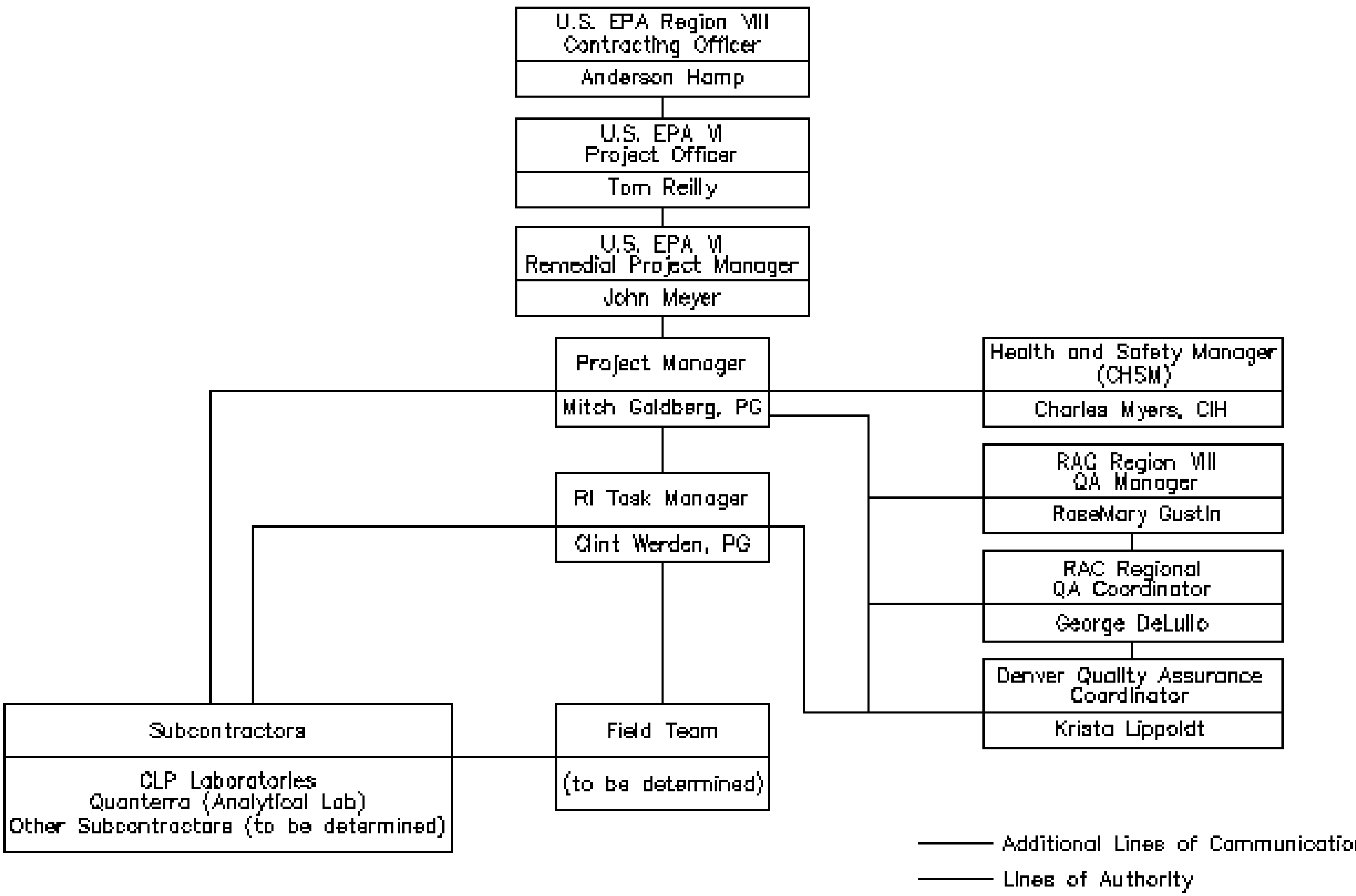
Click Map For Link To A Larger File



Click Map For Link To A Larger File

Click Map For Link To A Larger File





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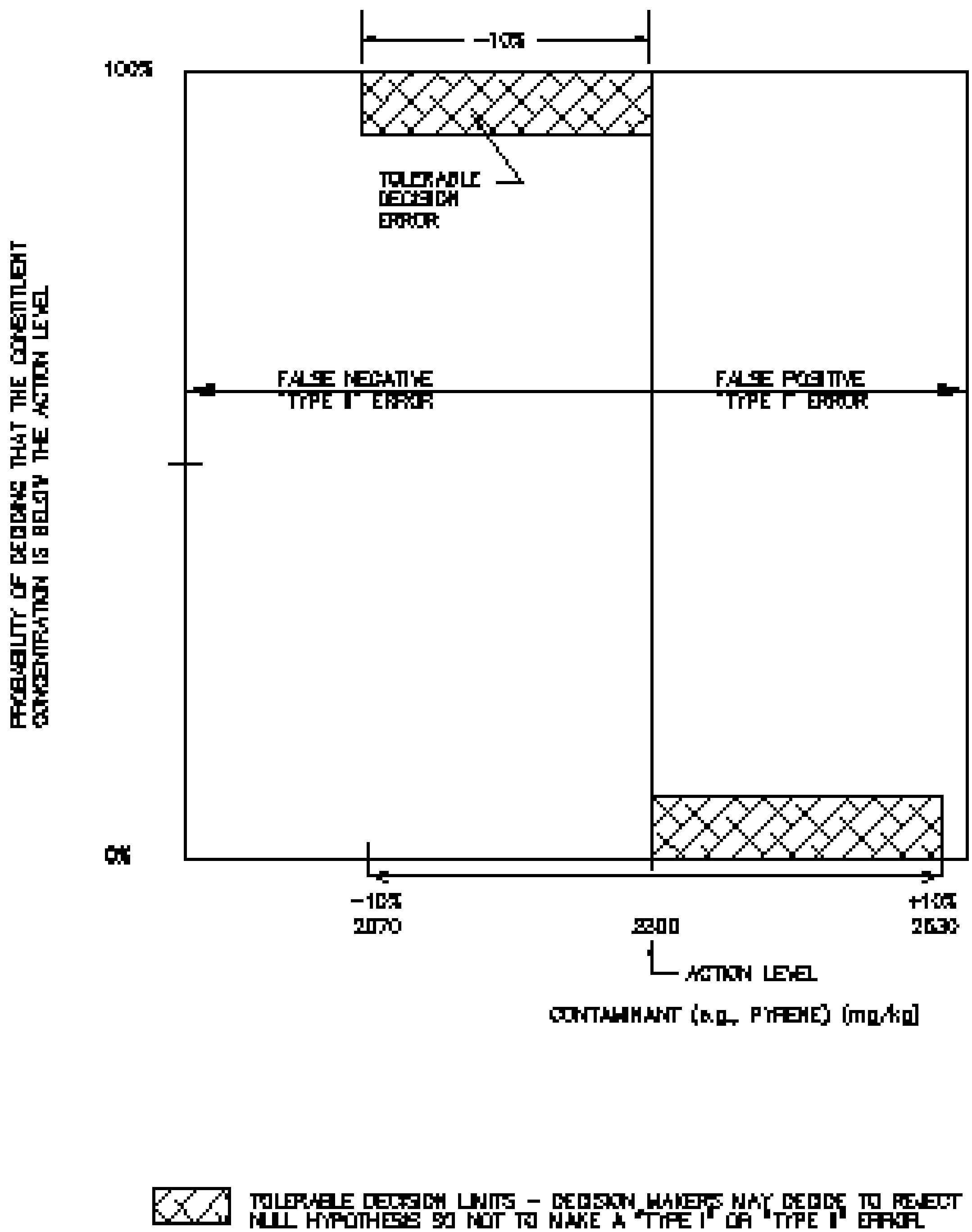
Project Team Organizational Chart

Bayou Verdine Area of Concern
Calcasieu Estuary, Louisiana

FIGURE 5-1



Example of Decision Errors and Tolerance Limits

Bayou Verdine Area of Concern
Calcasieu Estuary

Figure 5-2

TABLES

TABLE 1-1

PROJECT ACTIVITIES AND DELIVERABLE SCHEDULE
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Significant Activity/Deliverable	Tentative Completion Date*	Comments/Assumptions
Submit Draft Phase I SAP	August 31, 1999	Completed.
Submit Revised Phase I SAP	October 27, 1999	Completed; delayed due to Conoco's sampling on the bayou and EPA's evaluation.
Field Reconnaissance	November 15, 1999	14 days after Phase I SAP submittal.
Begin Phase I Field Work	December 6, 1999	14 days after Phase I SAP approval.
End Phase I Field Work	January 7, 2000	15-day sampling program.
Submit Draft Phase II SAP	May 31, 2000	Phase I data validation/evaluation completed.
Submit Final Phase II SAP	July 17, 2000	22 days after EPA review comments.
Begin Phase II Field Work	July 31, 2000	15 days after Phase II SAP approval.
End Phase II Field Work	August 23, 2000	Two 10-day shifts with two sampling crews.
Submit Draft Phase III SAP	November 30, 2000	Phase II data validation/evaluation completed.
Submit Final Phase III SAP	January 16, 2001	21 days after EPA review comments.
Begin Phase III Field Work	January 22, 2001	6 days after Phase III SAP approval.
End Phase III Field Work	January 31, 2001	One 10-day shift with two sampling crews.
Submit Draft Bayou Verdine AOC RI Report	July 18, 2001	120 days after Phase III data validation/evaluation completed.
Submit Draft Bayou Verdine AOC FS Report	July 30, 2001	15 days after Draft RI report.
Submit Final Bayou Verdine AOC RI Report	September 7, 2001	30 days after EPA review comments.
Submit Final Bayou Verdine AOC FS Report	September 12, 2001	15 days after EPA review comments.

* Schedule dates are based on Work Plan Revision No. 1 and on subsequent discussion during review of the Draft SAP. Note that all dates are dependant on EPA approvals and on an on-time completion of the previous activity.

TABLE 2-1

RANGE OF PHYSICOCHEMICAL PARAMETERS IN SURFACE WATER BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Parameter	Observed Value [1.]		Units
	Lowest	Highest	
Temperature	26.6	34.1	°C
pH	6.6	7.2	Standard pH units
Salinity	0.0109	0.0114	mg/L
Hardness	662	2280	as mg/L of $CaCO_3$
Dissolved Oxygen	1.81	5.57	mg/L
Specific Conductivity	3.42	28.69	mmhos/cm
Eh	NA	NA	mV
TDS	13.41	11941	mg/L
TSS	9	37	mg/L

Source: RTI. 1990. Appendix D, Ambient Chemistry Data. Toxics Study of the Lower Calcasieu River. March.

Notes:

1. Data covers both northern and southern reaches of Bayou Verdine at stations BV19 through BV23; except for salinity that was only measured at 2 of the 4 stations.

mg/L	=	Milligrams per Liter
$CaCO_3$	=	Calcium Carbonate
mmhos/cm	=	Millimhos per centimeter
mV	=	Millivolts
Eh	=	Electronic Potential
TDS	=	Total Dissolved Solids
TSS	=	Total Suspended Solids
°C	=	Degrees Celsius
NA	=	Not Available

TABLE 3-1

DESCRIPTION OF REACHES
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Reach*	Description/Physical Features
1	Southernmost reach of Bayou Verdine AOC. Reach 1 extends from the PPG North Dock (on the south) to Interstate Highway 10 (on the north) and it is downstream of heavy industrial reach. This reach passes through PPG property and is south of the Conoco property. There are no inputs to Reach 1 from Conoco (to the north). However, PPG (adjacent property) discharges non-contact cooling water to Reach 1 north of the PPG North Dock area. This reach does not include the PPG North Dock area because the of differing physical conditions. For example, the PPG Dock area is deeper (20 versus 6 to 8 feet), it is routinely dredged, and the likelihood of differing physical parameters (e.g., fauna, flora, temperature, pH, salinity, etc.) are great. Reach 1 is the only reach believed to be tidally influenced, and it is expected be the deepest of the five reaches and have the highest flow rate. Reach 1 is one of three reaches included in the Industrial segment of the Bayou Verdine AOC.
2	Heavy industrial reach of Bayou Verdine AOC. Reach 2 extends from Interstate Highway 10 (on the south) to Old Trousdale Road (on the west-northwest). This reach passes through the heavy industrial portion of the Conoco property. Three drainage ditches that pass through other industrial properties discharge to Bayou Verdine within Reach 2. The drainage ditches include the Vista West Ditch (to the northwest), the Faubacher Ditch (to the south central) and the Kansas City Railroad West Ditch (to the south). With three surface water inputs the flow rate in Reach 2 is anticipated to nearly equal, although slightly less than Reach 1. The depth of the bayou in Reach 2 is expected to be slightly less than Reach 1. Reach 2 is two of three reaches included in the Industrial segment of the Bayou Verdine AOC.
3	Light industrial reach of Bayou Verdine AOC. Reach 3 extends from Old Trousdale Road (on the east) to New Trousdale Road a power line easement (on the west). This reach passes through Conoco property, but lacks the potential for significant impact from influent waters, because of its upstream location to Reach 2. In addition to lees potential impact, the channel depth and flow rate in Reach 3 are likely less than those in Reach 2. Reach 3 is the third of three reaches included in the Industrial segment of the Bayou Verdine AOC.
4	Undeveloped commercial reach of Bayou Verdine AOC. Reach 4 extends from a New Trousdale Road power line easement (on the west) to Old Trousdale Road (on the north-northwest). This reach passes through primarily undeveloped property and lacks the potential for engineered/permitted discharges and accidental releases. Access to Reach 4 appears to be limited. The depth and width of the channel within this reach, as well as the flow rate are expected to be less than those in Reach 3. Also, the potential for industrial/commercial access to/use of Reach 4 is anticipated to be less than the potential for access and use by local residents (i.e., trespassers). Reach 4 is one of two reaches included in the Residential segment of the Bayou Verdine AOC.
5	Rural residential reach of Bayou Verdine AOC. Reach 5 extends from Old Trousdale Road (on the south) to just north of the Sabine Bypass Aqueduct. Reach 5 is the northernmost reach, and it is believed to be the least impacted from environmental contaminants, have the smallest channel dimensions, and the least surface water flow. One industrial input from the railroad yard west of the bayou is believed to exist on the southern portion of this reach. And, like Reach 4, Reach 5 is expected to be more consistent with recreational access/use rather than industrial/commercial use. Reach 5 is the second of two reaches included in the Residential segment of the Bayou Verdine AOC.

* - Refer to Figures 2-1 and 3-1 for location of Bayou Verdine AOC reaches.

TABLE 3-2
SAMPLE LOCATIONS AND SAMPLE TYPES
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

					Surface Sediment Sample (0 - 15 cm)										Deep Sediment Sample (15 - 30 and 30 - 45 cm) [2]					Shallow/Deep Surface Water Sample [3,4,5]											
					Primary								Ancilliary		Primary					Primary									Ancilliary		
				Analytes	Depth to Sediment	Water Quality Parameters	VOCs	SVOCs, Pesticides / PCBs	Herbicides	Total TAL Metals	Arsenic	Dioxins/ Furans	Other Parameters [1]	Field Eh Sample	VOCs	SVOCs, Pesticides/ PCBs	Herbicides	Total TAL Metals	Arsenic	VOCs	SVOCs	Pesticides/ PCBs	Herbicides	Total and Dissolved Tal Metals	Total As, Cu, Pb, and Hg (Unfiltered)	Dissolved As, Cu, Pb, and Hg (Filtered)	Cyanide	Dioxins/ Furans	Hardness	Other Parameter (Unpreserved) [6]	Other Inorganic Parameters(Preserved) [7]
				Containers			2 x 4 oz Wide Mouth Jar	1 x 8 oz Jar	1 x 4 oz Jar	1 x 8 oz Jar	1 x 4 oz Jar	1 x 4 oz Jar	1 x 8 oz Jar		2 x 120 ml Wide Mouth Jar	1 x 8 oz Jar	1 x 4 oz Jar	1 x 8 oz Jar	1 x 4 oz Jar	2 x 40 ml VOA Vials, HCl to pH<2	2 x 1 L Amber Bottles	2 x 1 L Amber Bottles	2 x 1 L Amber Bottles	2 x 1 L HDPE, HNO_3 to pH<2	1 x 1 L HDPE, HNO_3 to pH<2	1 x 1 L HDPE, HNO_3 to pH<2	1 x 1 L HDPE, NaOH to pH>12	2 x 1 L Amber Bottles	1 x 500 ml HDPE, HNO3 to pH<2	2 x 1 L Amber Bottles	2 x 1 L Amber Bottles, H_2SO4 to pH<2
Reach Number	Sample Location ID	UTM X Coordinate	UTM Y Coordinate	Laboratory	Field Measurement	Field Measurement	CLP or Houston	CLP or Houston	Quanterra	CLP or Houston	Quanterra	Quanterra	Quanterra	Field Measurement	CLP or Houston	CLP or Houston	Quanterra	CLP or Houston	Quanterra	CLP or Houston	CLP or Houston	CLP or Houston	Quanterra	Quanterra	Quanterra	Quanterra	Quanterra	Quanterra	Quanterra	Quanterra	Quanterra
1	R1-01	473186.30280	3345040.00000		X		X	X	O	X	O																				
1	R1-02	473149.78410	3344893.00000		X		X	X	O	X	O																				
1	R1-03	473028.05510	3344819.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O	O	O	O	O
1	R1-04	472875.02450	3344817.00000		X		X	X	O	X	O																				
1	R1-05	472783.43790	3344725.00000		X		X	X	O	X	O																				
1	R1-06	472784.59720	3344573.00000		X	X	X	X	O	X	O									X	X	X	O	O	O	O	O				
1	R1-07	472790.39380	3344422.00000		X		X	X	O	X	O																				
1	R1-08	472868.06850	3344294.00000		X		X	X	O	X	O																				
1	R1-09	472971.24830	3344183.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O		O	O	O
1	R1-10	473070.37050	3344073.00000		X		X	X	O	X	O																				
1	R1-11	473167.18880	3343958.00000		X		X	X	O	X	O																				
1	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
1	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
2	R2-01	472823.71030	3345925.00000		X		X	X	O	X	O																				
2	R2-02	472942.75760	3345834.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O	O	O	O	O
2	R2-03	473041.30440	3345719.00000		X		X	X	O	X	O																				
2	R2-04	473122.22780	3345593.00000		X	X	X	X	O	X	O									X	X	X	O	O	O	O	O				
2	R2-05	473183.72960	3345455.00000		X		X	X	O	X	O																				
2	R2-06	473235.16090	3345336.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O		O	O	O
2	R2-07	473222.93250	3345187.00000		X		X	X	O	X	O																				
2	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
2	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
3	R3-01	472121.99280	3345464.00000		X		X	X	O	X	O																				
3	R3-02	472265.71050	3345493.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O	O	O	O	O
3	R3-03	472262.26300	3345630.00000		X		X	X	O	X	O																				
3	R3-04	472311.29370	3345773.00000		X	X	X	X	O	X	O									X	X	X	O	O	O	O	O				
3	R3-05	472401.31110	3345893.00000		X		X	X	O	X	O																				
3	R3-06	472534.23040	3345964.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O		O	O	O
3	R3-07	472677.10910	3345953.00000		X		X	X	O	X	O																				
3	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
3	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
4	R4-01	471207.16470	3346152.00000		X		X	X	O	X	O																				
4	R4-02	471322.34180	3346060.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O	O	O	O	O
4	R4-03	471443.61120	3345977.00000		X		X	X	O	X	O																				
4	R4-04	471536.27970	3345862.00000		X	X	X	X	O	X	O									X	X	X	O	O	O	O	O				
4	R4-05	471594.10000	3345724.00000		X		X	X	O	X	O																				
4	R4-06	471700.54500	3345619.00000		X	X	X	X	O	X	O	O	O	O						X	X	X	O	O	O	O	O		O	O	O
4	R4-07	471840.70700	3345564.00000		X		X	X	O	X	O																				
4	R4-08	471982.54080	3345516.00000		X		X	X	O	X	O																				
4	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
4	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
5	R5-01	471038.44260	3347474.00000		X		X	X	O	X	O																				
5	R5-02	471070.97190	3347390.00000		X		X	X	O	X	O																				
5	R5-03	471122.72570	3347315.00000		X		X	X	O	X	O																				
5	R5-04	471188.83000	3347253.00000		X		X	X	O	X	O																				
5	R5-05	471257.98760	3347194.00000		X		X	X	O	X	O	O	O	O																	
5	R5-06	471324.39730	3347132.00000		X		X	X	O	X	O																				
5	R5-07	471382.10500	3347062.00000		X		X	X	O	X	O																				
5	R5-08	471426.68340	3346986.00000		X		X	X	O	X	O																				
5	R5-09	471412.18020	3346898.00000		X		X	X	O	X	O																				
5	R5-10	471363.63240	3346821.00000		X		X	X	O	X	O																				
5	R5-11	471292.64280	3346766.00000		X		X	X	O	X	O																				
5	R5-12	471220.43180	3346711.00000		X		X	X	O	X	O	O	O	O																	
5	R5-13	471165.77740	3346638.00000		X		X	X	O	X	O																				
5	R5-14	471130.66430	3346554.00000		X		X	X	O	X	O																				
5	R5-15	471117.68770	3346465.00000		X		X	X	O	X	O																				
5	R5-16	471117.22970	3346374.00000		X		X	X	O	X	O																				
5	R5-17	471133.56500	3346285.00000		X		X	X	O	X	O																				
5	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												
5	To be determined [3]	To be determined [3]	To be determined [3]												X	X	O	X	O												

Notes:
[1] Other Parameters include: CEC, pH, TOC, TPHs, and grain size.
[2] Locations for deep samples will be selected from locations where surface sediment results indicate the highest SVOC concentrations; a maximum of two sample locations per reach.
[3] The shallow fresh (or brackish) surface water samples will be collected from the upper one-third of the water column if gradation exists with respect to temperature, salinity, and conductivity. In the absence of gradation, this sample will be collected from the middle of the water column.
[4] The deep salt water samples will be collected from the bottom one-third of the water column if gradation exists with respect to temperature, salinity, and conductivity. In the absence of gradation, this sample will not be collected.
[5] A shallow and deep water sample will be collected from the same location only if gradation exist with respect to salinity.
[6] Other Parameters include: Alkalinity, BOD, TDS, TSS, TPHs, Bromide, Chloride, Fluoride, ortho-Phosphate, and Sulfate.
[7] Other Inorganic Parameters include: COD, TOC, TKN, Ammonia, and Nitrate/Nitrite.

UTM - Universal Transverse Mercator
X - Sample for CLP or Houston analysis
O - Sample for NON-CLP analysis
HDPE - High Density Polyethylene

oz - ounce
ml - milliliter
L - Liter

TABLE 3-3

SEDIMENT AND SURFACE WATER ANALYTICAL SUMMARY
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

NON-QC SAMPLES					QC SAMPLES					LABORATORY ALLOCATION													
										CLP ANALYSES					NON-CLP ANALYSES								
TYPE OF SAMPLE	SAMPLE LOCATION [1]	NUMBER OF SAMPLE LOCATIONS	NUMBER OF SAMPLES PER LOCATION	NUMBER OF NON-QC SAMPLES	DUPLICATE SAMPLES	RINSATE SAMPLES	MS/MSD [2]	TRIP BLANKS	TOTAL	TCL VOCs METHOD OLC 02.1 (water) & OLM 04.2 (solid)	TCL SVOCs METHOD OLC 02.1 (water) & OLM 04.2 (solid)	TOTAL TAL METALS [3] & CYANIDE METHOD ILM04.0	TCL PCBs METHOD OLC 02.1 (water) & OLM 04.2 (solid)	TCL PEST METHOD OLC 02.1 (water) & OLM 04.2 (solid)	TOTAL & DISSOLVED TAL METALS [3] METHOD 6010B	ARSENIC METHOD 7060A	COPPER METHOD 7211	LEAD METHOD 7421	MERCURY METHOD 7470A	CYANIDE METHOD 9010B	HERB METHOD 8150A	DIOXINS/ FURANS [4] METHOD 8290	TCLP METHOD 1311 (RESERVED)
Sediment Samples																							
Surface Sediment; 0 to 15 centimeter (cm) depth; Characterization sample.	One sample per grid (systematically spaced with random start).	50	1	50	5	3	3	31	89	89	58	58	58	58	0	58	0	0	0	0	58	12	0
Multi-Depth Sediment; 15 to 30-cm, and 30 to 45-cm depth; Vertical profile sample colocated with surface sediment sample.	Ten locations (maximum two per reach) at the highest SVOC detections surface sediment sample locations.	10	2	20	2	2	1	13	37	37	24	24	24	24	0	24	0	0	0	0	24	5	0
Surface Water Samples																							
Shallow Fresh Surface Water; Characterization sample. [5]	Colocated with deep surface water sample location at three locations per reach in Reaches 1 - 4. Upper one-third of water column.	12	1	12	2	5	1	7	26	26	19	0	19	19	38	19	19	19	19	19	19	4	0
Deep Brackish Saltier -Water; Characterization sample. [6]	Colocated with shallow surface water sample, if collected. Bottom one-third of water column.	12	1	12	2	5	1	7	26	26	19	0	19	19	38	19	19	19	19	19	19	4	0
Investigation Derived Waste Samples [7]																							
Aqueous	Aqueous waste stream composite	3	1	3	0	0	0	0	3	3	3	3	3	3	0	0	0	0	0	0	0	1	0
TOTAL		NA	NA	97	11	15	6	58	181	181	123	85	123	123	76	120	38	38	38	38	120	26	0

Notes:
[1] Sample locations are shown in Figure 3-1.
[2] MS/MSDs (Matrix Spike/Matrix Spike Duplicates) will be collected as triple volume for the CDM Federal Subcontract Laboratory QC at a rate of 5%, or 1 MS/MSD per (or up to) 20 samples.
EPA CLP requires single volume for MS/MSD at a rate 5% (1 per 20 samples per lab). Performance Evaluation (PE) samples will be used for CLP OLC 02.1 (aqueous) QC, because MS/MSD are not required by the SOW.
[3] Aqueous sample volumes collected for metal analysis will be filtered to reflect dissolved metal concentration and unfiltered for total metals concentrations.
[4] Dioxins/Furans sediment sample count (20%) is comprised of 14 non-QC samples, 2 duplicates, and 2 rinsates; and surface water sample count is comprised of 6 non-QC samples, 2 duplicates, and 2 rinsates.
[5] The shallow fresh (or brackish) surface water characterization sample will be collected from the upper one-third of the water column if gradation exist with respect to salinity. In the absence of gradation, this sample will be collected from the middle of the water column.
[6] The deep salt water characterization sample will be collected from the bottom one-third of the water column if gradation exist with respect to salinity. In the absence of gradation, this sample will not be collected.
[7] IDW samples will be analyzed for RCRA Metals, rather than TAL Metals following toxicity characteristic leaching procedure (TCLP) extraction SW-846 Method 1311, as appropriate.

QC - Quality Control
VOCs - Volatile Organic Compound
SVOCs - Semivolatile Organic Compound
PEST - Pesticides
HERB - Herbicides
PCBs - Polychlorinated Biphenyls
TAL - Target Analyte List
TCL - Target Compound List
CLP - Contract Laboratory Program
SOW - Statement of Work
NA - Not Applicable

TABLE 3-4

SEDIMENT AND SURFACE WATER PHYSICAL TESTING SUMMARY
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

TYPE OF LOCATION	SAMPLE LOCATION [1]	NUMBER OF LOCATIONS	NUMBER OF NON-QC SAMPLES	DUPLICATE SAMPLES	RINSATES SAMPLES	TOTAL NUMBER OF SAMPLES	SEDIMENT [2]					SURFACE WATER [3]										
							CEC 9081	pH 9045B	TOC 9060A	Grain Size D421/422	TPH 8015 MOD	Alkalinity 310.1	Hardness 130.2	BOD 405.1	COD 410.1	TOC 9060A	TDS 160.1	TSS 160.2	TKN 351.3	TPH 8015 MOD	Ammonia as (Nitrogen) 350.2	Major Anions 300.0
Sediment Samples																						
Surface Sediment: 0 to 15 cm	One sample per grid (systematically spaced with random start).	10	10	1	1	11	11	11	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rinsate sample		NA	NA	NA	1	1	NA	NA	1	NA	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water Samples																						
Shallow Surface Water; Characterization sample	Colocated with deep surface water sample location three locations per reach in Reaches 1-4. Upper one-third of the water column	12	12	2	1	14	NA	NA	NA	NA	NA	14	14	14	14	14	14	14	14	14	14	14
Deep Surface Water; Characterization sample	Colocated with the shallow surface water sample, if collected. Bottom one-third of the water column	12	12	2	1	14	NA	NA	NA	NA	NA	14	14	14	14	14	14	14	14	14	14	14
Rinsate sample		NA	NA	NA	2	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	2	2	2
TOTAL		22	34	5	3	42	11	11	12	11	12	28	28	28	28	30	28	28	28	30	30	30

Notes:
[1] Sample locations are shown in Figure 3-1.
[2] Onsite field measurements include penetrometer measurements, Eh, and VOC screening.
[3] Onsite field measurements include pH, Eh, temperature, conductivity, dissolved oxygen, and salinity.

BOD - Biological Oxygen Demand
CEC - Cation Exchange Capacity
COD - Chemical Oxygen Demand
Eh - Oxidation/reduction potential
QC - Quality Control
TDS - Total Dissolved Solids
TKN - Total Kjedahl Nitrogen
TOC - Total Organic Compounds
TPH - Total Petroleum Hydrocarbon
TSS - Total Suspended Solids
VOC - Volatile Organic Carbon
NA - Not Applicable

TABLE 4-1
PRIVATE PROPERTY ACCESS AND CONTACT INFORMATION
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Reach Number	Sample Location ID	UTM X Coordinate	UTM Y Coordinate	Adjacent Property Owners		Contact Person	Contact Number
1	R1-01	473186.30280	3345040.00000	Right of way		NA (PPG, Inc.)	NA
1	R1-02	473149.78410	3344893.00000	Lyondell Chemical Worldwide	First Trust Company of Montana	NA (PPG, Inc.)	NA
1	R1-03	473028.05510	3344819.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-04	472875.02450	3344817.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-05	472783.43790	3344725.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-06	472784.59720	3344573.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-07	472790.39380	3344422.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-08	472868.06850	3344294.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-09	472971.24830	3344183.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-10	473070.37050	3344073.00000	Olin Corporation		NA (PPG, Inc.)	NA
1	R1-11	473167.18880	3343958.00000	Right of way		NA (PPG, Inc.)	NA
2	R2-01	472823.71030	3345925.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
2	R2-02	472942.75760	3345834.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
2	R2-03	473041.30440	3345719.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
2	R2-04	473122.22780	3345593.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
2	R2-05	473183.72960	3345455.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
2	R2-06	473235.16090	3345336.00000	Kansas City Southern		Randy Apgar	NA
2	R2-07	473222.93250	3345187.00000	Right of way		Michael Hansen (Conoco)	NA
3	R3-01	472121.99280	3345464.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
3	R3-02	472265.71050	3345493.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
3	R3-03	472262.26300	3345630.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
3	R3-04	472311.29370	3345773.00000	Multiple owners	Conoco Inc.	Michael Hansen (Conoco)	NA
3	R3-05	472401.31110	3345893.00000	Harmon, Clayborn (Clabron)		Angelina Como	NA
3	R3-06	472534.23040	3345964.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
3	R3-07	472677.10910	3345953.00000	Conoco Inc.		Michael Hansen (Conoco)	NA
4	R4-01	471207.16470	3346152.00000	Jones, Ozanna		Michael Hansen (Conoco)	NA
4	R4-02	471322.34180	3346060.00000	Harmon, Clayborn (Clabron)		Angelina Como	NA
4	R4-03	471443.61120	3345977.00000	Harmon, Clayborn (Clabron)		Angelina Como	NA
4	R4-04	471536.27970	3345862.00000	Wilson, Leada	Multiple owners	Michael Hansen (Conoco)	NA
4	R4-05	471594.10000	3345724.00000	Wilson, Leada	Entergy Gulf States Inc.	Michael Hansen (Conoco)	NA
4	R4-06	471700.54500	3345619.00000	Conoco Inc.	Entergy Gulf States Inc.	Michael Hansen (Conoco)	NA
4	R4-07	471840.70700	3345564.00000	Entergy Gulf States Inc.		Paul Acosta	NA
4	R4-08	471982.54080	3345516.00000	Multiple owners		Michael Hansen (Conoco)	NA
5	R5-01	471038.44260	3347474.00000	Krause and Managan Lumber		NA	NA
5	R5-02	471070.97190	3347390.00000	Krause and Managan Lumber		NA	NA
5	R5-03	471122.72570	3347315.00000	Right of Way		NA	NA
5	R5-04	471188.83000	3347253.00000	Duke, Angele Managan		NA	NA
5	R5-05	471257.98760	3347194.00000	Duke, Angele Managan		NA	NA
5	R5-06	471324.39730	3347132.00000	Duke, Angele Managan		NA	NA
5	R5-07	471382.10500	3347062.00000	Duke, Angele Managan		NA	NA
5	R5-08	471426.68340	3346986.00000	Duke, Angele Managan		NA	NA
5	R5-09	471412.18020	3346898.00000	Duke, Angele Managan		NA	NA
5	R5-10	471363.63240	3346821.00000	Duke, Angele Managan		NA	NA
5	R5-11	471292.64280	3346766.00000	Duke, Angele Managan		NA	NA
5	R5-12	471220.43180	3346711.00000	Duke, Angele Managan		NA	NA
5	R5-13	471165.77740	3346638.00000	Duke, Angele Managan		NA	NA
5	R5-14	471130.66430	3346554.00000	Duke, Angele Managan		NA	NA
5	R5-15	471117.68770	3346465.00000	Kansas City Southern		Randy Apgar	NA
5	R5-16	471117.22970	3346374.00000	Kansas City Southern		Randy Apgar	NA
5	R5-17	471133.56500	3346285.00000	Kansas City Southern		Randy Apgar	NA

Notes: UTM - Universal Transverse Mercator NA - Not Available; EPA to provide contact information.

TABLE 4-2
FIELD EQUIPMENT AND SUPPLIES
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Item	Quantity
Sampling Equipment	
Site Trailer (approx 56' x 12' with central heat, air conditioning, and steps)	1
Temporary Fencing (approx 7' tall with double-wide gate)	200
Refuse dumpster and portable toilet	1
Refrigerator for sample preservation	1
Cargo Mini Van	1
Half Ton Truck	1
Floating Platform (barge or pontoon boat), approx 30' x 12' preferably with boom and moon pool. Also pushboat for platform (if platform is not powered).	1
Zodiac boat/Run-about (approx 10' - 15' with outboard motor and trailer)	1
Flat-bottom boat/shallow draft boat (approx 10' with outboard motor and trailer)	1
Adult Life Jackets (flotation aids)	6
Gasoline Storage Cans (5-gallon)	2
Differential GPS receiver and base (and other accessories)	1
Steam Cleaner	1
Tripod/Hoist/Boom capable lifting of 50 lbs (if floating platform has no boom)	1
Power Winch with 50' of cable and pulleys	NA
Generator (approximately 2.8 Hp, 1600 Watts, 11.7 Amp, 120 Volts for winch)	NA
Gravity Corer (3-in diameter x 12-in long)	2
Ponar Grab Sampler (Petite) (Standard - optional)	2
Van Dorn Water Sampler (Horizontal) (2.2 or 3-liter)	2
Van Dorn Water Sampler Bottom-Trip	2
Ekman Dredge (Pole-mounted)	2
Shelby Tubes (3-in dia.) (with drive head and 15 feet of push rod)	2
Sludge Sampler (2-in dia. with butterfly valve in shoe) (12-in long) (with push rod)	2
Depth data logger/fishfinder	2
Secchi disc	1
Depth Indicator (100 ft)	2
Coleman 40-quart cooler	40

TABLE 4-2 (CONTINUED)
FIELD EQUIPMENT AND SUPPLIES
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Item	Quantity
Field logbooks, waterproof	2
Scrub brushes	4
Cooler Ice (20 lb bags)	200
Sample Labels (50 labels/roll)	4
Vermiculite (20 lb. bag)	4
Self-sealing bags (1 gallon and 2 gallon) (20 bags/box)	100
Trash Bags (20 bags/box)	2
Decontamination Buckets, 5-Gallon	2
Cell phones	3
Video camera	1
Laptop computer	1
Peristaltic pump	2
1/4-inch PVC tubing (100 ft)	4
Pocket Penetrometer	2
Sample Jars (8 oz. wide-mouth glass with teflon-lined lids)	200
Sample Jars (8 oz. wide-mouth glass with teflon-lined lids)	200
Sample Jars (4 oz. wide-mouth glass with teflon-lined lids)	200
Sample Jars (1-liter bottles with teflon-lined lids)	100
Sample Jars (40-ml VOA with teflon septa)	100
Sample Jars (500-ml poly bottles)	50
Hydrochloric acid ampules (2-ml) (100 count)	2
Nitric acid ampules (2-ml) (100 count)	1
Sulfuric acid ampules (2-ml) (100 count)	1
Water Quality Monitor (pH, Eh, T, Cond., Salinity, DO, Turbidity)	2
CLP Sample Tags	400
CLP Organic and Inorganic Traffic Forms (each)	50
CLP Sample Labels for Organic Samples	300
CLP Sample Labels for Organic Samples	100

TABLE 4-2 (CONTINUED)
FIELD EQUIPMENT AND SUPPLIES
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Item	Quantity
Health and Safety Monitoring Equipment	
Photo-ionization detector (organic vapor monitor)	2
Respirators and Cartridges	3
Fire Extinguisher	1
First Aid Kit	1
Portable Eye Wash	1
Eye Protection	6
Latex Gloves (100 gloves/box)	3
Tyvek Coverall - long sleeved - L, XL	2
Booties	1
Decontamination Supplies	
Decontamination sprayer (plastic)	4
Methanol (liter)	4
Liqui-Nox phosphate free detergent (pint)	2
ASTM Water, 5-Gallons	10
4-mil clear polyethylene rolls (10' x 100')	2
Plastic Tubs	4

TABLE 5-1
DATA EVALUATION AND VALIDATION CRITERIA (1)
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

PARAMETER (METHODS)	TECHNICAL HOLDING TIME (2)	IPC	CALIBRATION		BLANKS	SMCs (SURROGATES)	ICS (SOLUTION AB)
			INITIAL	CONTINUING			
TAL METALS (SW-846 Methods 6010B/7000/ 9010B or CLP)	Mercury: 28 days Cyanide: 14 days Other Analytes: 180 days	NA	Mercury: 79 - 121% Cyanide: 84-116% Other Analytes: 89-111%		5 x Rule	NA	80 - 120%
OTHER INORGANIC PARAMETERS	Method specific (3)	NA	Use TAL Metal criteria, if applicable		5 x Rule	NA	80 - 120%, if applicable
VOCs (SW-846 Method 8260B or CLP)	Sediment:14 days Surface Water: 14 days (7 days if not preserved)	Ion Abundance Criteria (4)	%RSD < 30% and RRF > 0.05	%RSD < 25% and RRF > 0.05	5 x Rule except 10 x Rule for common laboratory contaminants	Limits specified by the Method (5)	NA
SVOCs (SW-846 Method 8270C or CLP)	Sediment: 14 days (extraction) (no analysis holding time) Surface Water: 7 days (extraction) 40 days (analysis)	Ion Abundance Criteria (4)	%RSD < 30% and RRF > 0.05	%RSD < 25% and RRF > 0.05	5 x Rule except 10 x Rule for common laboratory contaminants	Limits specified by the Method (5)	NA
PESTICIDES & PCBs (SW-846 Methods 8081A & 8082 or CLP)	Sediment: 14 days (extraction) (no analysis holding time) Surface Water: 7 days (extraction) 40 days (analysis)	Resolution Check and Performance Evaluation Mixtures (6)	Midpoint standard 4 x low point concentration and Resolution between two adjacent peaks </= 90% and Recorder deflections: 50 - 100% and %RSD < 20% except up to two may be 20 - 30%	Resolution between two adjacent peaks >/= 90% and %RSD < 25%	5 x Rule	Limits specified by the Method (5) and TCX retention time ± 0.05 minutes and DCB retention time ± 0.05 minutes	NA
DIOXINS/ FURANS (SW-846 8290 or CLP)	Sediment: 35 days (extraction) 40 days (analysis) Surface Water: 35 days (extraction) 40 days (analysis)	Chromatographic Resolution and Ion Abundance Criteria (7)	%RSD < 15%	%RSD < 30%	5 x Rule	NA	NA
TOTAL PETROLEUM HYDROCARBONS (Non-halogenated organics using GC/FID) (SW-846 8015 Modified)	Sediment: 14 days Surface Water: 14 day	NA	Method/Lab-Specific	Method/Lab-Specific	5 x Rule	Limits specified by the Method/Lab	NA

TABLE 5-1 (CONTINUED)
DATA EVALUATION AND VALIDATION CRITERIA (1)
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

PARAMETER (METHODS)	LCS	LABORATORY DUPLICATE	MS/MSD	INTERNAL STANDARDS	SERIAL DILUTION	FIELD DUPLICATE
TAL METALS (SW-846 Methods 6010B/7000/9010B or CLP)	Sediment: Limits established by EPA-EMSL/LV Surface Water: 80-120% except silver and anitmony (no criteria)	If both results >5 x CRDL: Sediment: < 35% Surface Water: < 20% If either result < 5 x CRDL: Sediment: < 2 x CRDL Surface Water: < 1 x CRDL	If sample result < 4 x Spike: 75 - 125% (post digestion spike not required for silver and mercury)	NA	If sample result > 50 x IDL: < 10%	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL
OTHER INORGANIC PARAMETERS	Use TAL METAL criteria, if applicable	Use TAL METAL criteria, if applicable	Use TAL METAL criteria, if applicable	NA	If sample result > 50 x IDL: < 10%	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL
VOCs (SW-846 Method 8260B or CLP)	Recovery limits provided on Form III, LCV-1 (required for low concentration water data)	NA	Advisory limits (8) (not required for low concentration water data)	Area counts: -50 to 100% Retention time: < 30 seconds	NA	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL
SVOCs (SW-846 Method 8270C or CLP)	Recovery limits provided on Form III LCSV (required for low concentration water data)	NA	Advisory limits (8) (not required for low concentration water data)	Area counts: -50 to 100% Retention time: < 30 seconds	NA	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL
PESTICIDES & PCBs (SW-846 Methods 8081A & 8082 or CLP)	Recovery limits provided on Form III LCP (required for low concentration water data)	NA	Advisory limits (8) (not required for low concentration water data)	NA	NA	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL
DIOXINS/ FURANS (SW-846 8290 or CLP)	NA	< 50%	50 - 150%	Ion ratio limits and Recovery limits (9)	NA	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL:
TOTAL PETROLEUM HYDROCARBONS (Non-halogenated organics using GC/FID) (SW-846 8015 Modified)	Recovery limits provided on Form III LCP	Method/Lab-specific	Method/Lab-specific	Area counts: -50 to 100% Retention time: < 30 seconds	NA	If both results >5 x CRDL: Sediment: < 50% Surface Water: < 35% If either result < 5 x CRDL: Sediment: < 4 x CRDL Surface Water: < 2 x CRDL

TABLE 5-1 (CONTINUED)
DATA EVALUATION AND VALIDATION CRITERIA (1)
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

FOOTNOTES:

(1) All criteria are for Surface Water, Sediment, and tissue samples unless otherwise noted. Tissue samples are treated as Sediment samples.
(2) Holding times are for samples preserved according to Table 5-2. If samples are not preserved as required, other criteria may be relevant.
(3) See analytes below:

Sediment:

pH:	immediate
Cation Exchage Capacity:	not specified
TOC:	28 days

Surface Water:

BOD:	48 hours	Nitrate/Nitrite:	28 days	Hardness:	6 months
COD:	28 days	Ortho-phosphate:	48 hours	Alkalinity:	14 days
TOC:	28 days	Sulfate:	28 days	Ammonia:	28 days
Bromide:	28 days	Total Kjeldahl Nitrogen:	28 days		
Chloride:	28 days	TDS:	7 days		
Fluoride:	28 days	TSS:	7 days		

(4) Ion Abundance Criteria:

VOCs

m/z	Required Intensity
50	15 to 40% of m/z 95
75	30 to 60% of m/z 95
95	Base peak, 100% relative abundance
96	5 to 9% of m/z 95
173	Less than 2% of m/z 174
174	Greater than 50% of m/z 95
175	5 to 9% of m/z 174
176	Greater than 95% but less than 101% of m/z 174
177	5 to 9% of m/z 176

Alternate tuning criteria may be used (e.g., CLP, Method 524.2, or manufacturers' instructions), provided that method performance is not adversely afftected.

SVOCs

m/z	Ion Abundance Criteria
51	30.0 - 80.0% of m/z 198
68	Less than 2.0% of m/z 69
69	Present
70	Less than 2.0% of m/z 69
127	25.0 - 75.0% of m/z 198
197	Less than 1.0% of m/z 198
198	Base peak, 100% relative abundance
199	5.0 - 9.0% of m/z 198
275	10.0 - 30.0% of m/z 198
365	Greater than 0.75% of m/z 198
441	Present, but less than m/z 443
442	40.0 - 110.0% of m/z 198
443	15.0 - 24.0% of m/z 442

(5) Surrogate Criteria (Percent Recovery):

VOCs (SW-846 Method 8260B)

	Sediment and Surface Water:
1,2-Dichloroethane-d4	Laboratory Determined
4-Bromofluorobenzene	Laboratory Determined
Toluene-d8	Laboratory Determined
Dibromofluoromethane (advisory)	Laboratory Determined

VOCs (CLP Method)

	Sediment:	Surface Water:
1,2-Dichloroethane-d4	84 - 138%	76 - 114%
4-Bromofluorobenzene	59 - 113%	86 - 115%
Toluene-d8	70 - 121%	88 - 110%

SVOCs (SW-846 Method 8270C)

	Sediment and Surface Water:
2-Fluorophenol	Laboratory Determined
Phenol-d5	Laboratory Determined
Nitrobenzene-d5	Laboratory Determined
2-Fluorobiphenyl	Laboratory Determined
2,4,6-Tribromophenol	Laboratory Determined
Terphenyl-d14	Laboratory Determined

SVOCs (CLP Method)

	Sediment:	Surface Water:
Nitrobenzene-d5	23 - 120%	35 - 114%
2-Fluorobiphenyl	30 - 115%	43 - 116%
Terphenyl-d14	18 - 137%	33 - 141%
Phenol-d5	24 - 113%	10 - 110%
2-Fluorophenol	25 - 121%	21 - 110%
2,4,6-Tribromophenol	19 - 122%	10 - 123%
2-Chlorophenol-d4 (advisory)	20 - 130%	33 - 110%
1,2-Dichlorobenzene-d4 (advisory)	20 - 130%	16 - 110%

Pesticides (SW-846 and CLP Methods)

	Sediment:	Surface Water:
Tetrachloro-m-xylene	30 - 150%	30 - 150%
Decachlorobiphenyl	30 - 150%	30 - 150%

(6) For resolution check mixtures, the depth of the valley between two adjacent peaks must be greater than or equal to 60.0% of the height of the shorter peak. For performance evaluation mixtures, the initial and continuing calibration resolution between adjacent peaks must be greater than or equal to 90%, the initial and continuing calibration retention times must be within the calculated retention time windows, and the % differences must be between -20 to +20%.

TABLE 5-1 (CONTINUED)
DATA EVALUATION AND VALIDATION CRITERIA (1)
BAYOU VERDINE AREA OF CONCERN

FOOTNOTES (CONTINUED):

(7) For chromatographic resolution results, the percent valley between the tetrachlorodibenzodioxin isomers must be < 25% and between the hexachlorodibenzochlorodioxin isomers must be < 50%. Ion Abundance Ration Criteria:

	Sediment and Surface Water:
Tetrachlorodibenzodioxins and furans	0.65 - 0.89
Pentachlorodibenzodioxins and furans	1.24 - 1.86
Hexachlorodibenzodioxins and furans	1.05 - 1.43
Heptachlorodibenzodioxins and furans	0.88 - 1.20
Octachlorodibenzodioxins and furans	0.76 - 1.02

(8) Matrix Spike/Matrix Spike Duplicate Criteria (Percent Recovery/Relative Percent Difference):
VOCs (SW-846 and CLP Methods)

	Sediment:	Surface Water:
1,1-Dichloroethene	59 - 172%/22	61 - 145%/14
Trichloroethene	62 - 137%/24	71 - 120%/14
Benzene	66 - 142%/21	76 - 127%/11
Toluene	59 - 139%/21	76 - 125%/13
Chlorobenzene	60 - 133%/21	75 - 130%/13

SVOCs (SW-846 and CLP Methods)

	Sediment:	Surface Water:
Phenol	26 - 90%/35	12 - 110%/42
2-Chlorophenol	25 - 102%/50	27 - 123%/40
1,4-Dichlorobenzene	28 - 104%/27	36 - 97%/28
N-Nitroso-di-n-propylamine	41 - 126%/38	41 - 116%/38
1,2,4-Trichlorobenzene	38 - 107%/23	39 - 98%/28
4-Chloro-3-methylphenol	26 - 103%/33	23 - 97%/42
Acenaphthene	31 - 137%/19	46 - 118%/31
4-Nitrophenol	11 - 114%/50	10 - 80%/50
2,4-Dinitrotoluene	28 - 89%/47	24 - 96%/38
Pentachlorophenol	17 - 109%/47	9 - 103%/50
Pyrene	35 - 142%/36	26 - 127%/31

Pesticides (SW-846 and CLP Methods)

	Sediment:	Surface Water:
gamma-BHC	46 - 127%/50	56 - 123%/15
Heptachlor	35 - 130%/31	40 - 131%/20
Aldrin	34 - 132%/43	40 - 120%/22
Dieldrin	31 - 134%/38	52 - 126%/18
Endrin	42 - 139%/45	56 - 121%/21
4-4'-DDT	23 - 134%/50	38 - 127%/27

(9) Internal Standard Criteria (Ion Ratio Limits/Percent Recovery):

Dioxins/Furans (SW-846 and CLP Methods)

	Sediment and Surface Water:
2,3,7,8-Tetra chlorodibenzofuran	0.65 - 0.89/25 - 150%
2,3,7,8-Tetra chlorodibenzodioxin	0.65 - 0.89/25 - 150%
1,2,3,6,7,8-Hexachlorodibenzodioxin	1.05 - 1.43/25 - 150%
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.88 - 1.20/25 - 150%
Octachlorodibenzodioxin	0.76 - 1.01/25 - 150%

Shaded areas include criteria for data validation only.
IPC = Instrument Performance Check
SMCs = Standard Monitoring Compounds
ICS = Interference Check Sample
TAL = Target Analyte List
CLP = Contract Laboratory Program
NA = Not Applicable
VOCs = Volatile Organic Compounds
%RSD = Percent Relative Standard Deviation
RRF = Relative Response Factor
SVOCs = Semivolatile Organic Compounds
PCBs = Polychlorinated Biphenyls
TCX = Tetrachloro-m-xylene
DCB = Decachlorobiphenyl
CRDL = Contract Required Detection Limit
IDL = Instrument Detection Limit

TABLE 5-2
SAMPLE CONTAINERS, PRESERVATION, AND MINIMAL VOLUME REQUIREMENT
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

PARAMETER (METHODS)	SPECIFIC ANALYSIS, WHEN APPLICABLE	MEDIA	CONTAINER(S)	PRESERVATION	MINIMAL VOLUME REQUIREMENT
TAL METALS (SW-846 Methods 6010B/7000/9010B/9012)		Surface Water	2 x 1 L HDPE	4° C ± 2° C and 1 L: HNO3 to pH<2 (Metals) 1 L: NaOH to pH>12 (Cyanide)	1100 mL
TAL METALS (ILM 04.0)		Surface Water	2 x 1 L HDPE	1 L: HNO3 to pH<2 (Metals) 1 L: 4° C ± 2° C and NaOH to pH>12 (Cyanide)	400 mL
		Sediment	1 x 8 oz clear glass	4° C ± 2° C	8 g
OTHER INORGANIC PARAMETERS:	Alkalinity (EPA Method 310.1) BOD (EPA Method 405.1) TDS (EPA Method 160.1) TSS (EPA Method 160.2) Bromide (EPA Method 300.0) Chloride (EPA Method 300.0) Fluoride (EPA Method 300.0) Ortho-phosphate (EPA Method 300.0) Sulfate (EPA Method 300.0)	Surface Water	2 x 1 L glass	4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C 4° C ± 2° C	50 mL 300 mL 100 mL 200 mL 100 mL 100 mL 100 mL 100 mL 100 mL
	COD (EPA Method 410.1) TOC (SW-846 Method 9060) TKN (EPA Method 351.3) Ammonia (EPA Method 350.2) Nitrate/Nitrite (EPA Method 300.0)	Surface Water	2 x 1 L glass	4° C ± 2° C and H2SO4 to pH<2 4° C ± 2° C and H2SO4 to pH<2 4° C ± 2° C and H2SO4 to pH<2 4° C ± 2° C and H2SO4 to pH<2 4° C ± 2° C and H2SO4 to pH<2	50 mL 25 mL 500 mL 400 mL 100 mL
	Hardness (EPA Method 130.2)	Surface Water	1 x 100 mL HDPE	4° C ± 2° C and HNO3 to pH<2	25 mL
	CEC (SW-846 Method 9081) pH (SW-846 Method 9045B) TOC (SW-846 Method 9060) Grain Size (ASTM D422)	Sediment	1 x 8 oz clear glass	None None 4° C ± 2° C None	6 g 20 g 60 g 115 g
VOCs (SW-846 Method 8260B)		Surface Water	2 x 40 mL VOA vial	4° C ± 2° C and HCl to pH<2	10mL
		Sediment	2 x 4 oz clear glass	4° C ± 2° C	30 g
VOCs (OLC 02.1 and OLM 04.2)		Surface Water	2 x 40 mL VOA vial	4° C ± 2° C and HCl to pH<2	5 mL
		Sediment	2 x 4 oz clear glass	4° C ± 2° C	10 g
SVOCs (SW-846 Method 8270C or OLC 02.1 and OLM 04.2)		Surface Water	2 x 1 L amber glass	4° C ± 2° C	1 L
		Sediment	1 x 8 oz clear glass	4° C ± 2° C	30 g
PESTICIDES/PCBs (SW-846 Methods 8081A/ 8082 or OLC 02.1 and OLM 04.2)		Surface Water	2 x 1 L amber glass	4° C ± 2° C	1 L
		Sediment	1 x 8 oz clear glass	4° C ± 2° C	30 g
HERBICIDES (SW-846 Method 8151)		Surface Water	2 x 1 L amber glass	4° C ± 2° C	1 L
		Sediment	1 x 8 oz clear glass	4° C ± 2° C	30 g
DIOXINS/FURANS (SW-846 8290)		Surface Water	2 x 1 L amber glass	4° C ± 2° C	1 L
		Sediment	1 x 4 oz clear glass	4° C ± 2° C	10 g
TOTAL PETROLEUM HYDROCARBONS (SW-846 8015 MOD)		Surface Water	2 x 1 L amber glass	4° C ± 2° C	1 L
		Sediment	1 x 8 oz clear glass	4° C ± 2° C	30 g

NOTES:
1. The container requirements do not consider combining analyses (e.g., pesticides and PCBs).

Refer to definitions and abbreviations in Table 5-1.

TABLE 5-3
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Sediment Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
TAL METALS (6010B unless noted)/OTHER INORGANIC ANALYSES					
Aluminum	--	40	7	mg/kg	--
Antimony (7041)	2	12	0.6	mg/kg	Long and Morgan freshwater ERL
Arsenic (7060A)	8.2	23	0.2	mg/kg	NOAA SQRTs/Long et al. ERLs
Barium	--	40	0.4	mg/kg	--
Beryllium	--	1	0.06	mg/kg	--
Cadmium	1.2	1	0.8	mg/kg	NOAA SQRTs/Long et al. ERLs
Calcium	--	1000	2	mg/kg	--
Chromium	81	2	1.4	mg/kg	NOAA SQRTs/Long et al. ERLs
Cobalt	--	10	1.2	mg/kg	--
Copper	34	5	1.2	mg/kg	NOAA SQRTs/Long et al. ERLs
Iron	20000	20	1.4	mg/kg	OME freshwater LEL
Lead	46.7	0.6	8.4	mg/kg	NOAA SQRTs/Long et al. ERLs
Magnesium	--	1000	6	mg/kg	--
Manganese	0.46	3	0.4	mg/kg	OME freshwater LEL
Mercury (7471A)	0.15	0.2	0.2	mg/kg	NOAA SQRTs/Long et al. ERLs
Nickel	20.9	8	3	mg/kg	NOAA SQRTs/Long et al. ERLs
Potassium	--	1000	1000	mg/kg	--
Silver (7761)	1	2	0.04	mg/kg	NOAA SQRTs/Long et al. ERLs
Sodium	--	1000	5.8	mg/kg	--
Thallium	--	2	8	mg/kg	--
Vanadium	--	10	1.6	mg/kg	--
Zinc	150	4	0.4	mg/kg	NOAA SQRTs/Long et al. ERLs
Cyanide	--	0.2	0.5	mg/kg	--
TCL PESTICIDES					
4,4-DDD	2	3.3	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
4,4-DDE	2.2	3.3	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
4,4-DDT	1	3.3	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
Aldrin	2	1.7	1.7	ug/kg	OME freshwater LEL
alpha-BHC	6	1.7	1.7	ug/kg	OME freshwater LEL
alpha-Chlordane	--	1.7	1.7	ug/kg	--
beta-BHC	5	1.7	1.7	ug/kg	OME freshwater LEL
Chlordane (technical)	0.5	NL	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
delta-BHC	--	1.7	1.7	ug/kg	--
Dieldrin	0.02	3.3	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
Endosulfan I	5.5	1.7	1.7	ug/kg	NOAA SQRTs/Long et al. ERLs
Endosulfan II	--	3.3	1.7	ug/kg	--
Endosulfan sulfate	--	3.3	1.7	ug/kg	--
Endrin	2.67	3.3	1.7	ug/kg	CCME TEL freshwater sediment
Endrin aldehyde	--	3.3	1.7	ug/kg	--
Endrin ketone	--	3.3	1.7	ug/kg	--
gamma-BHC (Lindane)	0.32	1.7	1.7	ug/kg	CCME marine TEL
gamma-Chlordane	--	1.7	1.7	ug/kg	--
Heptachlor	68	1.7	1.7	ug/kg	ORNL (EqP)
Heptachlor epoxide	0.6	1.7	1.7	ug/kg	CCME freshwater TEL
Methoxychlor	19	17	3.3	ug/kg	ORNL (EqP)
Toxaphene	--	170	17	ug/kg	--
PCBs					
Aroclor 1016	7	33	33	ug/kg	OME freshwater LEL
Aroclor 1221	120	67	33	ug/kg	ORNL (EqP) freshwater
Aroclor 1232	600	33	33	ug/kg	ORNL (EqP) freshwater
Aroclor 1242	170	33	33	ug/kg	ORNL (EqP) freshwater
Aroclor 1248	30	33	33	ug/kg	OME freshwater LEL
Aroclor 1254	60	33	33	ug/kg	OME freshwater LEL
Aroclor 1260	5	33	33	ug/kg	OME freshwater LEL
Total PCBs	22.7	67	33	ug/kg	NOAA SQRT ERL
VOCs					
1,1,1-Trichloroethane	--	10	5	ug/kg	--
1,1,2,2-Tetrachloroethane	--	10	5	ug/kg	--
1,1,2-Trichloroethane	--	10	5	ug/kg	--
1,1-Dichloroethane	--	10	5	ug/kg	--
1,1-Dichloroethene	--	10	5	ug/kg	--
1,2,3-Trichloropropane	--	NL	5	ug/kg	--
1,2-Dibromoethane (EDB)	--	NL	5	ug/kg	--
1,2-Dichloroethane	--	10	5	ug/kg	--
1,2-Dichloroethene (total)	--	10	5	ug/kg	--
1,2-Dichloropropane	--	10	5	ug/kg	--
1,4-Dioxane	--	NL	5	ug/kg	--
2-Butanone (MEK)	--	10	5	ug/kg	--
2-Chloroethyl vinyl ether	--	NL	50	ug/kg	--
2-Hexanone	--	10	20	ug/kg	--
4-Methyl-2-pentanone	--	10	20	ug/kg	--
Acetone	--	10	20	ug/kg	--
Acrolein	--	NL	100	ug/kg	--
Acrylonitrile	--	NL	100	ug/kg	--

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Sediment Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
Benzene	--	10	5	ug/kg	--
Bromodichloromethane	--	10	5	ug/kg	--
Bromoform	--	10	5	ug/kg	--
Bromomethane	--	10	10	ug/kg	--
Carbon disulfide	--	10	5	ug/kg	--
Carbon tetrachloride	--	10	5	ug/kg	--
Chlorobenzene	--	10	5	ug/kg	--
Chloroethane	--	10	10	ug/kg	--
Chloroform	--	10	10	ug/kg	--
Chloromethane	--	10	10	ug/kg	--
cis-1,2-Dichloroethene	--	NL	2.5	ug/kg	--
cis-1,3-Dichloropropene	--	10	5	ug/kg	--
Dibromochloromethane	--	10	5	ug/kg	--
Dibromomethane	--	NL	5	ug/kg	--
Dichlorodifluoromethane	--	NL	10	ug/kg	--
Ethanol	--	NL	500	ug/kg	--
Ethyl methacrylate	--	NL	5	ug/kg	--
Ethylbenzene	--	10	5	ug/kg	--
Hexane	--	NL	5	ug/kg	--
Iodomethane	--	NL	5	ug/kg	--
Methyl tert-butyl ether	--	NL	20	ug/kg	--
Methylene chloride	--	10	5	ug/kg	--
m-Xylene & p-Xylene	--	10	2.5	ug/kg	--
o-Xylene	--	10	2.5	ug/kg	--
Styrene	--	10	5	ug/kg	--
tert-Butyl alcohol	--	NL	200	ug/kg	--
Tetrachloroethene	--	10	5	ug/kg	--
Tetrahydrofuran	--	NL	20	ug/kg	--
Toluene	--	10	5	ug/kg	--
trans-1,2-Dichloroethene	--	NL	2.5	ug/kg	--
trans-1,3-Dichloropropene	--	10	5	ug/kg	--
trans-1,4-Dichloro-2-butene	--	NL	5	ug/kg	--
Trichloroethene	--	10	5	ug/kg	--
Trichlorofluoromethane	--	10	10	ug/kg	--
Vinyl acetate	--	NL	10	ug/kg	--
Vinyl chloride	--	10	10	ug/kg	--
Xylenes (total)	--	10	5	ug/kg	--
SVOCs					
1,2,4-Trichlorobenzene	--	330	330	ug/kg	--
1,2-Dichlorobenzene	--	330	330	ug/kg	--
1,3-Dichlorobenzene	--	330	330	ug/kg	--
1,4-Dichlorobenzene	--	330	330	ug/kg	--
1-Methylnaphthalene	--	NL	330	ug/kg	--
2,2-oxybis(1-Chloropropane)	--	330	330	ug/kg	--
2,4,5-Trichlorophenol	--	830	330	ug/kg	--
2,4,6-Trichlorophenol	--	330	330	ug/kg	--
2,4-Dichlorophenol	--	330	330	ug/kg	--
2,4-Dimethylphenol	--	330	330	ug/kg	--
2,4-Dinitrophenol	--	830	1600	ug/kg	--
2,4-Dinitrotoluene	--	330	330	ug/kg	--
2,6-Dinitrotoluene	--	330	330	ug/kg	--
2-Chloronaphthalene	--	330	330	ug/kg	--
2-Chlorophenol	--	330	330	ug/kg	--
2-Methylnaphthalene	70	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
2-Methylphenol	--	330	330	ug/kg	--
2-Nitroaniline	--	830	1600	ug/kg	--
2-Nitrophenol	--	330	330	ug/kg	--
3,3-Dichlorobenzidine	--	330	660	ug/kg	--
3-Methylphenol & 4-Methylphenol	--	330	330	ug/kg	--
3-Nitroaniline	--	830	1600	ug/kg	--
4,6-Dinitro-2-methylphenol	--	830	1600	ug/kg	--
4-Bromophenyl phenyl ether	--	330	330	ug/kg	--
4-Chloro-3-methylphenol	--	330	330	ug/kg	--
4-Chloroaniline	--	330	330	ug/kg	--
4-Chlorophenyl phenyl ether	--	330	330	ug/kg	--
4-Methylphenol	--	330	330	ug/kg	--
4-Nitroaniline	--	830	1600	ug/kg	--
4-Nitrophenol	--	830	1600	ug/kg	--
Acenaphthene	16	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Acenaphthylene	44	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Aniline	--	NL	330	ug/kg	--
Anthracene	85.3	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Azobenzene	--	NL	330	ug/kg	--
Benzidine	--	NL	3300	ug/kg	--
Benzo(a)anthracene	261	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Benzo(a)pyrene	430	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Benzo(b)fluoranthene	--	330	330	ug/kg	--
Benzo(ghi)perylene	--	330	330	ug/kg	--
Benzo(k)fluoranthene	--	330	330	ug/kg	--

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Sediment Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
Benzoic acid	--	NL	1600	ug/kg	--
Benzyl alcohol	--	NL	330	ug/kg	--
bis(2-Chloroethoxy)methane	--	330	330	ug/kg	--
bis(2-Chloroethyl) ether	--	NL	330	ug/kg	--
bis(2-Ethylhexyl) phthalate	182	330	330	ug/kg	CCME marine TEL
Butyl benzyl phthalate	--	NL	330	ug/kg	--
Carbazole	--	NL	330	ug/kg	--
Chrysene	384	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Dibenz(a,h)anthracene	63.4	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Dibenzofuran	--	330	330	ug/kg	--
Diethyl phthalate	--	330	660	ug/kg	--
Dimethyl phthalate	--	NL	330	ug/kg	--
Di-n-butyl phthalate	--	330	330	ug/kg	--
Di-n-octyl phthalate	--	330	330	ug/kg	--
Fluoranthene	600	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Fluorene	19	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Hexachlorobenzene	--	330	330	ug/kg	--
Hexachlorobutadiene	--	330	330	ug/kg	--
Hexachlorocyclopentadiene	--	330	1600	ug/kg	--
Hexachloroethane	--	330	330	ug/kg	--
Indene	--	NL	330	ug/kg	--
Indene(1,2,3-cd)pyrene	--	330	330	ug/kg	--
Isophorone	--	330	330	ug/kg	--
Naphthalene	160	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Nitrobenzene	--	330	330	ug/kg	--
N-Nitrosodimethylamine	--	NL	330	ug/kg	--
N-Nitrosodi-n-propylamine	--	330	330	ug/kg	--
N-Nitrosodiphenylamine	--	330	330	ug/kg	--
Pentachlorophenol	--	830	1600	ug/kg	--
Phenanthrene	240	330	330	ug/kg	NOAA SQRTs/Long et al. ERLs
Phenol	--	330	330	ug/kg	--
Pyrene	665	330	660	ug/kg	NOAA SQRTs/Long et al. ERLs
Pyridine	--	NL	660	ug/kg	--
TCL DIOXINS/FURANS					
2378-TCDD	--	0.001	0.000001	ug/kg	--
2378-TCDF	--	0.001	0.000001	ug/kg	--
12378-PeCDF	--	0.0025	0.000001	ug/kg	--
12378-PeCDD	--	0.0025	0.000001	ug/kg	--
23478-PeCDF	--	0.0025	0.000001	ug/kg	--
123478-HxCDF	--	0.0025	0.0000025	ug/kg	--
123678-HxCDF	--	0.0025	0.0000025	ug/kg	--
123478-HxCDD	--	0.0025	0.0000025	ug/kg	--
123678-HxCDD	--	0.0025	0.0000025	ug/kg	--
123789-HxCDD	--	0.0025	0.0000025	ug/kg	--
234678-HxCDF	--	0.0025	0.0000025	ug/kg	--
123789-HxCDF	--	0.0025	0.0000025	ug/kg	--
1234678-HpCDF	--	0.0025	0.0000025	ug/kg	--
1234678-HpCDD	--	0.0025	0.0000025	ug/kg	--
1234789-HpCDF	--	0.0025	0.0000025	ug/kg	--
OCDD	--	0.005	0.000005	ug/kg	--
OCDF	--	0.005	0.000005	ug/kg	--
Total TCDD	--	NL	0.000001	ug/kg	--
Total TCDF	--	NL	0.000001	ug/kg	--
Total PeCDD	--	NL	0.000001	ug/kg	--
Total PeCDF	--	NL	0.000001	ug/kg	--
Total HxCDD	--	NL	0.0000025	ug/kg	--
Total HxCDF	--	NL	0.0000025	ug/kg	--
Total HpCDD	--	NL	0.0000025	ug/kg	--
Total HpCDF	--	NL	0.0000025	ug/kg	--

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Soil Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
TAL METALS (6010B unless noted)/OTHER INORGANIC ANALYSES					
Aluminum	3.825	40	7	mg/kg	ES/ER/TM-86/R3 raw data
Antimony (7041)	0.248	12	0.6	mg/kg	ES/ER/TM-86/R3 raw data
Arsenic (7060A)	0.25	2	0.2	mg/kg	ES/ER/TM-86/R3 raw data
Barium	19.7	40	0.4	mg/kg	ES/ER/TM-86/R3 raw data
Beryllium	2.42	1	0.06	mg/kg	ES/ER/TM-86/R3 raw data
Boron	0.5	NL	0.8	mg/kg	ORNL
Bromine	10	NL	NL	mg/kg	ES/ER/TM-85/R3
Cadmium	0.006	1	0.8	mg/kg	ORNL
Calcium	--	1000	2	mg/kg	--
Chromium VI*	2	2	1.4	mg/kg	ORNL
Chromium III*	0.35	2	1.4	mg/kg	ORNL
Cobalt	20	10	1.4	mg/kg	ORNL
Copper	10	5	1.2	mg/kg	ORNL
Flourine	30	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
Iodine	4	NL	NL	mg/kg	ES/ER/TM-85/R3
Iron	139	20	1.4	mg/kg	ORNL
Lanthanum	50	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 2
Lead	0.94	0.6	8.04	mg/kg	ES/ER/TM-86/R3 raw data
Lithiuim	2	NL	0.56	mg/kg	ES/ER/TM-85/R3
Magnesium	--	1000	6	mg/kg	--
Manganese	100	3	0.4	mg/kg	ORNL
Molybdenum	0.52	NL	1.6	mg/kg	ES/ER/TM-86/R3 raw data
Mercury	0.00051	0.2	0.2	mg/kg	ORNL
Nickel	10	8	3	mg/kg	ORNL
Potassium	--	1000	ND	mg/kg	--
Selenium	0.1	1	15	mg/kg	ORNL
Silver	1.8	2	1.4	mg/kg	ORNL
Sodium	--	1000	0.58	mg/kg	--
Strontium	963	NL	0.06	mg/kg	ES/ER/TM-86/R3 raw data
Technetium	0.2	NL	NL	mg/kg	ES/ER/TM-85/R3
Thallium	0.027	2	8	mg/kg	ES/ER/TM-86/R3 raw data
Tin	5.6	NL	3.4	mg/kg	ES/ER/TM-86/R3 raw data
Titanium	1000	NL	1	mg/kg	ES/ER/TM-126/R2 Table 2
Tungsten	400	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 2
Uranium	5	NL	NL	mg/kg	ES/ER/TM-85/R3
Vanadium	0.714	10	1.6	mg/kg	ES/ER/TM-86/R3 raw data
Zinc	8.5	4	0.4	mg/kg	ORNL
Zirconium	3.449	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
Total Cyanide	0.1	2	0.5	mg/kg	ORNL
Chloride	--	NL	Not Analyzed	mg/kg	--
Chlorine	--	NL	Not Analyzed	mg/kg	--
Nitrates	2325	NL	Not Analyzed	mg/kg	ES/ER/TM-86/R3 raw data
pH (9045C)	--	NL	NL	mg/kg	--
Phosphorus - elemental	--	NL	Not Analyzed	mg/kg	--
Sulfide-Hydrogen Sulfide	--	NL	Not Analyzed	mg/kg	--
Fluoride	6.5	NL	Not Analyzed	mg/kg	ES/ER/TM-86/R3 raw data
TCL PESTICIDES/HERBICIDES					
4,4-DDD	--	0.0033	0.0017	mg/kg	--
4,4-DDE	--	0.0033	0.0017	mg/kg	--
4,4-DDT	--	0.0033	0.0017	mg/kg	--
Aldrin	0.733	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
alpha-BHC	--	0.0017	0.0017	mg/kg	--
alpha-Chlordane	--	0.0017	0.0017	mg/kg	--
beta-BHC	1.47	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
BHC mixed isomers	0.07	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
Chlordane (technical)	1.8	NL	0.017	mg/kg	ES/ER/TM-86/R3 raw data
Chlordecone (kepone)	0.293	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
DDT and metabolites	0.002	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
delta-BHC	--	0.0017	0.0017	mg/kg	--
Dieldrin	0.064	0.0033	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
Endosulfan I	0.55	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
Endosulfan II	--	0.0033	0.0017	mg/kg	--
Endosulfan sulfate	--	0.0033	0.0017	mg/kg	--
Endrin	0.008	0.0033	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
Endrin aldehyde	--	0.0033	0.0017	mg/kg	--
Endrin ketone	--	0.0033	0.0017	mg/kg	--
gamma-BHC (Lindane)	1.66	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
gamma-Chlordane	--	0.0017	0.0017	mg/kg	--
Guthion	--	NL	NL	mg/kg	--
Heptachlor	0.476	0.0017	0.0017	mg/kg	ES/ER/TM-86/R3 raw data
Heptachlor epoxide	--	0.0017	0.0017	mg/kg	--
Methoxychlor	14.7	0.017	0.033	mg/kg	ES/ER/TM-86/R3 raw data
Toxaphene	29.3	0.17	0.017	mg/kg	ES/ER/TM-86/R3 raw data
Chlorophenoxy Herbicide 2,4,5,-TP	--	NL	0.00028	mg/kg	--
Chlorophenoxy Herbicide 2,4-D	--	NL	0.00011	mg/kg	--
Chloropyrifos	--	NL	0.0017	mg/kg	--

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Soil Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
Malathion	--	NL	NL	mg/kg	--
Mirex	--	NL	0.0017	mg/kg	--
Parathion	--	NL	NL	mg/kg	--
PCBs					
Aroclor 1016	6.52	0.033	0.033	mg/kg	ES/ER/TM-86/R3 raw data
Aroclor 1221	--	0.067	0.033	mg/kg	--
Aroclor 1232	--	0.033	0.033	mg/kg	--
Aroclor 1242	0.329	0.033	0.033	mg/kg	ES/ER/TM-86/R3 raw data
Aroclor 1248	0.071	0.033	0.033	mg/kg	ES/ER/TM-86/R3 raw data
Aroclor 1254	0.111	0.033	0.033	mg/kg	ES/ER/TM-86/R3 raw data
Aroclor 1260	--	0.033	0.033	mg/kg	--
Total PCBs	40	0.067	0.033	mg/kg	ES/ER/TM-85/R3
VOCs					
1,1,1-Trichloroethane	2060	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
1,1,2,2-Tetrachloroethane	--	0.01	0.005	mg/kg	--
1,1,2-Trichloroethane	--	0.01	0.005	mg/kg	--
1,1-Dichloroethane	--	0.01	0.005	mg/kg	--
1,1-Dichloroethene	23.5	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
1,2,3-Trichloropropane	--	NL	0.005	mg/kg	--
1,2,3-Trichlorobenzene	20	NL	0.005	mg/kg	ES/ER/TM-126/R2 Table 1
1,2,4-Trichlorobenzene	20	NL	0.005	mg/kg	ES/ER/TM-126/R2 Table 1
1,2-Dibromoethane (EDB)	--	NL	0.005	mg/kg	--
1,2-Dichlorobenzene	--	NL	0.005	mg/kg	--
1,2-Dichloroethane (EDC)	14.2	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
1,2-Dichloroethene (total)	89.6	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
1,2-Dichloropropane	700	0.01	0.005	mg/kg	ES/ER/TM-126/R2 Table 1
1,3-Dichlorobenzene	--	NL	0.005	mg/kg	--
1,3-Dichloropropene	--	0.01	0.005	mg/kg	--
1,4-Dichlorobenzene	20	NL	0.005	mg/kg	ES/ER/TM-126/R2 Table 1
1,4-Dioxane	1.83	NL	0.5	mg/kg	ES/ER/TM-86/R3 raw data
2-Butanone (MEK)	6487	0.01	0.02	mg/kg	ES/ER/TM-86/R3 raw data
2-Chloroethyl vinyl ether	--	NL	0.05	mg/kg	--
2-Hexanone	--	0.01	0.02	mg/kg	--
4-Methyl-2-pentanone	91.6	0.01	0.02	mg/kg	ES/ER/TM-86/R3 raw data
Acetone	36.6	0.01	0.02	mg/kg	ES/ER/TM-86/R3 raw data
Acrolein	--	NL	0.1	mg/kg	--
Acrylonitrile	1000	NL	0.1	mg/kg	ES/ER/TM-126/R2 Table 2
Benzene	52.2	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
Bromodichloromethane	--	NL	0.005	mg/kg	--
Bromoform	--	NL	0.005	mg/kg	--
Bromomethane	--	0.01	0.01	mg/kg	--
Carbon disulfide	--	0.01	0.005	mg/kg	--
Carbon tetrachloride	58.6	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
Chloroacetamide	2	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 1
Chlorobenzene	40	0.01	0.005	mg/kg	ES/ER/TM-126/R2 Table 1
Chloroethane	--	0.01	0.01	mg/kg	--
Chloroform	55	0.01	0.01	mg/kg	ES/ER/TM-86/R3 raw data
Chloromethane	--	0.01	0.01	mg/kg	--
cis-1,2-Dichloroethene	--	NL	0.0025	mg/kg	--
cis-1,3-Dichloropropene	--	0.01	0.005	mg/kg	--
cis-1,4-Dichloro-2-butene	1000	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 2
Dibromochloromethane	--	0.01	0.005	mg/kg	--
Dibromomethane	--	NL	0.005	mg/kg	--
Dichlorodifluoromethane	--	NL	0.01	mg/kg	--
Ethanol	117	NL	0.5	mg/kg	ES/ER/TM-86/R3 raw data
Ethyl acetate	330	NL	0.01	mg/kg	ES/ER/TM-86/R3 raw data
Ethyl methacrylate	--	NL	0.005	mg/kg	--
Ethylbenzene	--	0.01	0.005	mg/kg	--
Hexane	--	NL	0.005	mg/kg	--
Hexachlorobenzene	1000	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 2
Hexachlorocyclohexane -Technical	--	NL	NL	mg/kg	--
Iodomethane	--	NL	0.005	mg/kg	--
Methanol	183.2	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
Methyl Bromide	--	NL	NL	mg/kg	--
Methyl tert-butyl ether	--	NL	0.02	mg/kg	--
Methylene chloride	21.4	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
m-Xylene & p-Xylene	--	0.01	0.0025	mg/kg	--
o-Xylene	--	0.01	0.0025	mg/kg	--
Styrene	300	NL	0.005	mg/kg	ES/ER/TM-85/R3
tert-Butyl alcohol	--	NL	0.2	mg/kg	--
Tetrachloroethene	2.77	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
Tetrahydrofuran	--	NL	0.02	mg/kg	--
Toluene	51.5	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
trans-1,2-Dichloroethene	--	0.01	0.0025	mg/kg	--
trans-1,3-Dichloropropene	--	0.01	0.005	mg/kg	--
trans-1,4-Dichloro-2-butene	1000	NL	0.005	mg/kg	ES/ER/TM-126/R2 Table 2

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Soil Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
Trichloroethane	--	0.01	0.005	mg/kg	--
Trichloroethene	1.387	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
Trichlorofluoromethane	--	NL	0.01	mg/kg	--
Vinyl acetate	--	NL	0.01	mg/kg	--
Vinyl chloride	0.623	0.01	0.01	mg/kg	ES/ER/TM-86/R3 raw data
Xylenes (total)	4.162	0.01	0.005	mg/kg	ES/ER/TM-86/R3 raw data
SVOCs					
1,2,4-Trichlorobenzene	--	0.33	0.33	mg/kg	--
1,2,4,5-Tetrachlorobenzene	--	NL	0.33	mg/kg	--
1,2-Diphenylhydrazine	--	NL	0.33	mg/kg	--
1,2-Dichlorobenzene	--	0.33	0.33	mg/kg	--
1,3-Dichlorobenzene	--	0.33	0.33	mg/kg	--
1,4-Dichlorobenzene	--	0.33	0.33	mg/kg	--
1-Methylnaphthalene	--	NL	0.33	mg/kg	--
2,2-oxybis(1-Chloropropane)	--	0.33	0.33	mg/kg	--
2,3,4,5-Tetrachlorophenol	20	NL	ND	mg/kg	ES/ER/TM-126/R2 Table 1
2,3,5,6-Tetrachloraniline	20	NL	0.33	mg/kg	ES/ER/TM-85/R3
2,4,5-Trichloroaniline	20	NL	NL	mg/kg	ES/ER/TM-85/R3
2,4,5-Trichlorophenol	4	0.33	0.33	mg/kg	ES/ER/TM-85/R3
2,4,6-Trichlorophenol	10	0.33	0.33	mg/kg	ES/ER/TM-85/R3
2,4-Dichloroaniline	100	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 1
2,4-Dichlorophenol	--	0.33	0.33	mg/kg	--
2,4-Dimethylphenol	--	0.33	0.33	mg/kg	--
Dinitrophenols	--	NL	NL	mg/kg	--
2,4-Dinitrophenol	20	0.8	1.6	mg/kg	ES/ER/TM-85/R3
2,4-Dinitrotoluene	--	0.33	0.33	mg/kg	--
2,6-Dinitrotoluene	--	0.33	0.33	mg/kg	--
2-Chloronaphthalene	--	0.33	0.33	mg/kg	--
2-Chlorophenol	--	0.33	0.33	mg/kg	--
2-Cresol (2-Methylphenol)	1043.9	0.33	0.33	mg/kg	--
2-Methylnaphthalene	--	0.33	0.33	mg/kg	--
2-Methylphenol*	--	0.33	0.33	mg/kg	--
2-Nitroaniline	--	0.8	1.6	mg/kg	--
2-Nitrophenol	--	0.33	0.33	mg/kg	--
3,3-Dichlorobenzidine	--	0.33	1.6	mg/kg	--
3-Methylphenol & 4-Methylphenol	--	0.33	0.33	mg/kg	--
3-Chloroaniline	20	NL	NL	mg/kg	ES/ER/TM-85/R3
3-Chlorophenol	7	NL	NL	mg/kg	ES/ER/TM-85/R3
3-Nitroaniline	--	0.8	1.6	mg/kg	--
3,4-Dichloroaniline	20	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 2
3,4-Dichlorophenol	20	NL	NL	mg/kg	ES/ER/TM-85/R3
4,6-Dinitro-2-methylphenol	--	0.8	1.6	mg/kg	--
4-Bromoanaline	--	NL	NL	mg/kg	--
4-Bromophenyl phenyl ether	--	0.33	0.33	mg/kg	--
4-Chloro-3-methylphenol	--	0.33	0.33	mg/kg	--
4-Chlorophenol	--	NL	NL	mg/kg	--
4-Chloroaniline	--	0.33	0.33	mg/kg	--
4-Chlorophenyl phenyl ether	--	0.33	0.33	mg/kg	--
4-Methylphenol	--	0.33	0.33	mg/kg	--
4-Nitroaniline	--	0.8	1.6	mg/kg	--
4-Nitrophenol	7	0.8	1.6	mg/kg	ES/ER/TM-126/R2 Table 2
Acenaphthene	20	0.33	0.33	mg/kg	ES/ER/TM-85/R3
Acenaphthylene	--	0.33	0.33	mg/kg	--
Aniline	--	NL	0.33	mg/kg	--
Anthracene	--	0.33	0.33	mg/kg	--
Azobenzene	--	NL	0.33	mg/kg	--
Benzidine	--	NL	3.3	mg/kg	--
Benzo(a)anthracene	--	0.33	0.33	mg/kg	--
Benzo(a)pyrene	1.98	0.33	0.33	mg/kg	ES/ER/TM-86/R3 raw data
Benzo(b)fluoranthene	--	0.33	0.33	mg/kg	--
Benzo(ghi)perylene	--	0.33	0.33	mg/kg	--
Benzo(k)fluoranthene	--	0.33	0.33	mg/kg	--
Benzoic acid	--	NL	1.6	mg/kg	--
Benzyl alcohol	--	NL	0.33	mg/kg	--
Biphenyl	60	NL	NL	mg/kg	ES/ER/TM-85/R3
bis(2-Chloroethoxy)methane	--	0.33	0.33	mg/kg	--
bis(2-Chloroethyl) ether	--	0.33	0.33	mg/kg	--
bis Chloromethyl ether	--	NL	NL	mg/kg	--
bis(2-Ethylhexyl) phthalate	0.91	0.33	0.33	mg/kg	ES/ER/TM-86/R3 raw data
Butyl benzyl phthalate	--	0.33	0.33	mg/kg	--
Carbazole	--	0.33	0.33	mg/kg	--
Chrysene	--	0.33	0.33	mg/kg	--
Dibenz(a,h)anthracene	--	0.33	0.33	mg/kg	--
Dibenzofuran	--	0.33	0.33	mg/kg	--
Diethyl phthalate	100	0.33	0.66	mg/kg	ES/ER/TM-85/R3
Dimethyl phthalate	200	NL	0.33	mg/kg	ES/ER/TM-126/R2 Table 1
Di-n-butyl phthalate	0.09	0.33	0.33	mg/kg	ES/ER/TM-86/R3 raw data

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Soil Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
Di-n-hexylphthalate	109	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
Di-n-octyl phthalate	--	0.33	0.33	mg/kg	--
Formaldehyde	83.3	NL	NL	mg/kg	ES/ER/TM-86/R3 raw data
Fluoranthene	--	0.33	0.33	mg/kg	--
Fluorene	30	0.33	0.33	mg/kg	ES/ER/TM-126/R2 Table 1
Hexachlorobenzene	--	0.33	0.33	mg/kg	--
Hexachlorobutadiene	--	0.33	0.33	mg/kg	--
Hexachlorocyclopentadiene	10	0.33	1.6	mg/kg	ES/ER/TM-85/R3
Hexachloroethane	--	0.33	0.33	mg/kg	--
Indene	--	NL	0.33	mg/kg	--
Indeno(1,2,3-cd)pyrene	--	0.33	0.33	mg/kg	--
Isophorone	--	0.33	0.33	mg/kg	--
Naphthalene	--	0.33	0.33	mg/kg	--
Nitrobenzene	40	0.33	0.33	mg/kg	ES/ER/TM-126/R2 Table 1
Nitrosamines	--	NL	NL	mg/kg	--
N-Nitrosodimethylamine	--	NL	0.33	mg/kg	--
N-Nitrosodi-n-propylamine	--	0.33	0.33	mg/kg	--
N-Nitrosodiphenylamine	20	0.33	0.33	mg/kg	ES/ER/TM-126/R2 Table 1
N-Nitrosodibutylamine	--	NL	0.33	mg/kg	--
N-Nitrosodiethylamine	--	NL	0.33	mg/kg	--
N-Nitrosopyrrolidine	--	NL	0.33	mg/kg	--
Pentachloroanaline	100	NL	NL	mg/kg	ES/ER/TM-126/R2 Table 1
Pentachlorobenzene	20	NL	1.6	mg/kg	ES/ER/TM-126/R2 Table 1
Pentachloronitrobenzene	5.854	NL	1.6	mg/kg	ES/ER/TM-86/R3 raw data
Pentachlorophenol	0.879	0.8	1.6	mg/kg	ES/ER/TM-86/R3 raw data
Phenanthrene	--	0.33	0.33	mg/kg	--
Phenol (total)	30	NL	0.33	mg/kg	ES/ER/TM-126/R2 Table 1
Pyrene	--	0.33	0.33	mg/kg	--
Pyridine	--	NL	0.66	mg/kg	--
Demeton	--	NL	ND	mg/kg	--
Malathion	--	NL	ND	mg/kg	--
Parathion	--	NL	ND	mg/kg	--
1,2,3,4-Tetrachlorobenzene	10	NL	ND	mg/kg	ES/ER/TM-126/R2 Table 1
4-Toluidine	--	NL	ND	mg/kg	--
Hexachlorobenzene	1000	NL	0.66	mg/kg	ES/ER/TM-126/R2 Table 2
TCL DIOXINS/FURANS					
2378-TCDD	0.0000003	0.001	0.000001	mg/kg	ES/ER/TM-86/R3 raw data
2378-TCDF	0.0000008	0.001	0.000001	mg/kg	ES/ER/TM-86/R3 raw data
12348-PeCDF	0.176	0.0025	0.000001	mg/kg	ES/ER/TM-86/R3 raw data
12378-PeCDD	--	0.0025	0.000001	mg/kg	--
23478-PeCDF	0.00006	0.0025	0.000001	mg/kg	ES/ER/TM-86/R3 raw data
123478-HxCDF	--	0.0025	0.0000025	mg/kg	--
123678-HxCDF	0.00059	0.0025	0.0000025	mg/kg	ES/ER/TM-86/R3 raw data
123478-HxCDD	--	0.0025	0.0000025	mg/kg	--
123678-HxCDD	--	0.0025	0.0000025	mg/kg	--
123789-HxCDD	--	0.0025	0.0000025	mg/kg	--
234678-HxCDF	--	0.0025	0.0000025	mg/kg	--
123789-HxCDF	--	0.0025	0.0000025	mg/kg	--
1234678-HpCDF	--	0.0025	0.0000025	mg/kg	--
1234678-HpCDD	--	0.0025	0.0000025	mg/kg	--
1234789-HpCDF	--	0.0025	0.0000025	mg/kg	--
OCDD	--	0.005	0.000005	mg/kg	--
OCDF	--	0.005	0.000005	mg/kg	--
Total TCDD	--	NL	0.000001	mg/kg	--
Total TCDF	--	NL	0.000001	mg/kg	--
Total PeCDD	--	NL	0.000001	mg/kg	--
Total PeCDF	--	NL	0.000001	mg/kg	--
Total HxCDD	--	NL	0.0000025	mg/kg	--
Total HxCDF	--	NL	0.0000025	mg/kg	--
Total HpCDD	--	NL	0.0000025	mg/kg	--
Total HpCDF	--	NL	0.0000025	mg/kg	--
Furan	600	NL	0.0000025	mg/kg	ES/ER/TM-85/R3

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Ecological Surface Water - Salt Water Screening Level	Human Health Secondary Contact/consumption Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
TAL METALS (6010B unless noted)/OTHER INORGANIC ANALYSES						
Aluminum	87	--	200	45	ug/L	FAWQC freshwater CCC pH 6.5-9.0
Antimony	--	4300	60	32	ug/L	FAWQC HH consumption
Arsenic (7060a)	36	0.14	10	1	ug/L	LA chronic/HH DWS
Barium	--	1300	200	2	ug/L	FAWQC HH consumption + water
Beryllium	--	--	5	0.3	ug/L	--
Boron	--	--	NL	NL	ug/L	--
Cadmium	9.3	10	5	4	ug/L	FAWQC-saltwater CCC/HH DWS
Calcium	--	--	5000	10	ug/L	--
Chromium VI*	50	50	10	7	ug/L	LA chronic/HH DWS
Chromium III*	103	50	10	7	ug/L	LA chronic/HH DWS
Cobalt	--	--	50	7	ug/L	--
Copper (7211)	3.1	1000	25	1	ug/L	FAWQC CCC/HH DWS
Iron	1000	300	100	7	ug/L	FAWQC freshwater CCC/FAWQC HH consumption + water
Lead (7421)	8.1	50	3	1	ug/L	FAWQC-saltwater CCC/HH DWS
Magnesium	--	--	5000	30	ug/L	--
Manganese	--	100	15	2	ug/L	FAWQC HH consumption
Mercury (7470A)	0.025	0.051	0.2	0.2	ug/L	LA chronic/FAWQC HH consumption
Nickel	8.2	4600	40	15	ug/L	FAWQC CCC/FAWQC HH consumption
Potassium	--	--	5000	3000	ug/L	--
Selenium (7740)	71	11000	5	2	ug/L	FAWQC CCC
Silver (7761)	1.9	--	10	0.2	ug/L	FAWQC CMC
Sodium	--	--	5000	29	ug/L	--
Thallium (7841)	--	6.3	10	1	ug/L	FAWQC HH consumption
Vanadium	--	--	50	8	ug/L	--
Zinc	81	69000	20	2	ug/L	FAWQC CCC/FAWQC HH consumption
Total Cyanide	1	12844	10	0.5	ug/L	FAWQC CCC/LA NDWS
Chloride	230000	--	NL	780	ug/L	FAWQC freshwater CCC
Chlorine	7.5	--	NL	NL	ug/L	FAWQC CCC
Nitrates	--	10000	NL	420	ug/L	FAWQC HH consumption + water
pH (9040)	6.5-8.5	5.0-9.0	NL	NL	pH units	FAWQC CCC/FAWQC HH consumption + water
Phosphorus - elemental	--	--	NL	690	ug/L	FAWQC CCC
Sulfide-Hydrogen Sulfide	--	--	NL	Not Analyzed	ug/L	FAWQC CCC
TCL PESTICIDES/HERBICIDES						
4,4-DDD	0.25	0.00027	0.1	0.05	ug/L	LA chronic/LA NDWS
4,4-DDE	0.14	0.00019	0.1	0.05	ug/L	LA chronic/LA NDWS
4,4-DDT	0.001	0.00019	0.1	0.05	ug/L	LA chronic/LA NDWS
Aldrin	1.3	0.00004	0.05	0.05	ug/L	FAWQC CMC & LA acute/LA NDWS
alpha-BHC	--	0.013	0.05	0.05	ug/L	FAWQC HH consumption
alpha-Chlordane	--	--	0.05	0.05	ug/L	--
beta-BHC	--	0.046	0.05	0.05	ug/L	FAWQC HH consumption
Chlordane (technical)	0.004	0.00019	NL	..5	ug/L	LA chronic/LA NDWS
delta-BHC	--	--	0.05	0.05	ug/L	--
Demeton	--	--	NL	0.05	ug/L	FAWQC CCC
Dieldrin	0.0019	0.00005	0.1	0.05	ug/L	LA chronic/LA NDWS
Endosulfan I	0.0087	240	0.05	0.05	ug/L	LA chronic/FAWQC HH consumption
Endosulfan II	0.0087	240	0.1	0.05	ug/L	LA chronic/FAWQC HH consumption
Endosulfan sulfate	--	240	0.1	0.05	ug/L	FAWQC HH consumption
Endrin	0.0023	0.26	0.1	0.05	ug/L	LA chronic/LA NDWS
Endrin aldehyde	--	0.81	0.1	0.05	ug/L	FAWQC HH consumption
Endrin ketone	--	--	0.1	0.05	ug/L	--
gamma-BHC (Lindane)	0.16	0.063	0.05	0.05	ug/L	LA acute and FAWQC CMC/FAWQC HH consumption
gamma-Chlordane	--	--	0.05	0.05	ug/L	--
Guthion	--	--	NL	NL	ug/L	FAWQC CCC
Heptachlor	0.0036	0.00007	0.05	0.05	ug/L	LA chronic and FAWQC CCC/LA NDWS
Heptachlor epoxide	0.0036	0.00011	0.05	0.05	ug/L	FAWQC CCC/FAWQC HH consumption
Methoxychlor	0.03	100	0.05	0.1	ug/L	FAWQC CCC/FAWQC HH consumption + water
Toxaphene	0.0002	0.00024	5	2	ug/L	LA chronic and FAWQC CCC/LA NDWS
Chlorophenoxy Herbicide 2,4,5,-TP	--	10	NL	0.075	ug/L	FAWQC HH consumption + water
Chlorophenoxy Herbicide 2,4-D	--	100	NL	0.2	ug/L	FAWQC HH consumption + water
Chloropyrifos	0.0056	--	NL	NL	ug/L	FAWQC CCC
Mirex	0.001	--	NL	10	ug/L	FAWQC CCC
PCBs						
Aroclor 1016	--	--	1	1	ug/L	--
Aroclor 1221	--	--	2	1	ug/L	--
Aroclor 1232	--	--	1	1	ug/L	--
Aroclor 1242	--	--	1	1	ug/L	--
Aroclor 1248	--	--	1	1	ug/L	--
Aroclor 1254	--	--	1	1	ug/L	--
Aroclor 1260	--	--	1	1	ug/L	--
Total PCBs	0.03	0.00001	1	1	ug/L	LA chronic and FAWQC CCC/LA NDWS
VOCs						
1,1,1-Trichloroethane	1560	200	10	5	ug/L	LA chronic/LA DWS

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Ecological Surface Water - Salt Water Screening Level	Human Health Secondary Contact/consumption Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
1,1,2,2-Tetrachloroethane	451	1.8	10	5	ug/L	LA chronic/LA NDWS
1,1,2-Trichloroethane	900	6.9	10	5	ug/L	LA freshwater chronic/LA NDWS
1,1-Dichloroethane	--	--	10	5	ug/L	--
1,1-Dichloroethene	11200	0.58	10	5	ug/L	LA chronic/LA NDWS
1,2,3-Trichloropropane	--	--	NL	5	ug/L	--
1,2-Dibromoethane (EDB)	--	--	NL	5	ug/L	--
1,2-Dichloroethane (EDC)	5650	6.8	10	5	ug/L	LA chronic/LA NDWS
1,2-Dichloroethene (total)	--	--	10	5	ug/L	--
1,2-Dichloropropane	--	39	10	5	ug/L	FAWQC HH consumption
1,3-Dichloropropene	39.5	162.79	10	5	ug/L	LA chronic/LA NDWS
1,4-Dioxane	--	--	NL	200	ug/L	--
2-Butanone (MEK)	--	--	10	20	ug/L	--
2-Chloroethyl vinyl ether	--	--	NL	10	ug/L	--
2-Hexanone	--	--	10	20	ug/L	--
4-Methyl-2-pentanone	--	--	10	20	ug/L	--
Acetone	--	--	10	20	ug/L	--
Acrolein	--	780	NL	20	ug/L	FAWQC HH consumption
Acrylonitrile	--	0.66	NL	100	ug/L	FAWQC HH consumption
Benzene	1350	12.5	10	5	ug/L	LA chronic/LA NDWS
Bromodichloromethane	--	3.3	10	5	ug/L	LA NDWS
Bromoform	895	34.7	10	5	ug/L	LA chronic/LA NDWS
Bromomethane	--	--	10	10	ug/L	--
Carbon disulfide	--	--	10	5	ug/L	--
Carbon tetrachloride	7500	1.2	10	5	ug/L	LA chronic/LA NDWS
Chlorobenzene	--	21000	10	5	ug/L	FAWQC HH consumption
Chloroethane	--	--	10	10	ug/L	--
Chloroform	4075	70	10	5	ug/L	LA chronic/LA NDWS
Chloromethane	13500	--	10	10	ug/L	LA chronic
cis-1,2-Dichloroethene	--	--	NL	2.5	ug/L	--
cis-1,3-Dichloropropene	39.5	162.79	10	5	ug/L	LA chronic/LA NDWS
Dibromochloromethane	--	5.08	10	NL	ug/L	LA NDWS
Dibromomethane	--	--	NL	5	ug/L	--
Dichlorodifluoromethane	--	--	NL	10	ug/L	--
Ethanol	--	--	NL	NL	ug/L	--
Ethyl methacrylate	--	--	NL	1	ug/L	--
Ethylbenzene	4380	8100	10	5	ug/L	LA chronic/LA NDWS
Hexane	--	--	NL	NL	ug/L	--
Hexachlorocyclo-hexane -Technical	--	0.0414	NL	NL	ug/L	FAWQC HH consumption
Iodomethane	--	--	NL	5	ug/L	--
Methyl Bromide	--	4000	NL	NL	ug/L	FAWQC HH consumption
Methyl tert-butyl ether	--	--	NL	5	ug/L	--
Methylene chloride	12800	87	10	5	ug/L	LA chronic/LA NDWS
m-Xylene & p-Xylene	--	--	10	2.5	ug/L	--
o-Xylene	--	--	10	2.5	ug/L	--
Styrene	--	--	10	5	ug/L	--
tert-Butyl alcohol	--	--	NL	NL	ug/L	--
Tetrachloroethene	510	2.5	10	5	ug/L	LA chronic/LA NDWS
Tetrahydrofuran	--	--	NL	10	ug/L	--
Toluene	475	46200	10	5	ug/L	LA chronic/LA NDWS
trans-1,2-Dichloroethene	--	140000	NL	2.5	ug/L	FAWQC HH consumption
trans-1,3-Dichloropropene	--	--	10	5	ug/L	--
trans-1,4-Dichloro-2-butene	--	--	NL	1	ug/L	--
Trichloroethene	100	21	10	5	ug/L	LA chronic/LA NDWS
Trichlorofluoromethane	--	--	NL	10	ug/L	--
Vinyl acetate	--	--	NL	10	ug/L	--
Vinyl chloride	--	35.8	10	10	ug/L	LA NDWS
Xylenes (total)	--	--	10	5	ug/L	--
SVOCs						
1,2,4-Trichlorobenzene	--	940	10	10	ug/L	FAWQC HH consumption
1,2,4,5-Tetrachlorobenzene	--	2.9	NL	10	ug/L	FAWQC HH consumption
1,2-Diphenylhydrazine	--	0.54	NL	10	ug/L	FAWQC HH consumption
1,2-Dichlorobenzene	--	17000	10	10	ug/L	FAWQC HH consumption
1,3-Dichlorobenzene	--	2600	10	10	ug/L	FAWQC HH consumption
1,4-Dichlorobenzene	--	2600	10	10	ug/L	FAWQC HH consumption
1-Methylnaphthalene	--	--	NL	10	ug/L	--
2,2-oxybis(1-Chloropropane)	--	--	10	10	ug/L	--
2,4,5-Trichlorophenol	--	9800	25	10	ug/L	FAWQC HH consumption
2,4,6-Trichlorophenol	--	6.5	10	10	ug/L	FAWQC HH consumption
2,4-Dichlorophenol	101	232.6	10	10	ug/L	LA freshwater chronic/LA NDWS
2,4-Dimethylphenol	--	2300	10	10	ug/L	FAWQC HH consumption
Dinitrophenols	--	14000	NL	NL	ug/L	FAWQC HH consumption
2,4-Dinitrophenol	--	14000	25	10	ug/L	FAWQC HH consumption
2,4-Dinitrotoluene	--	9.1	10	10	ug/L	FAWQC HH consumption

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Ecological Surface Water - Salt Water Screening Level	Human Health Secondary Contact/consumption Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
2,6-Dinitrotoluene	--	--	10	10	ug/L	--
2-Chloronaphthalene	--	4300	10	10	ug/L	FAWQC HH consumption
2-Chlorophenol	129	126.4	10	10	ug/L	LA freshwater chronic/LA NDWS
2-Methylnaphthalene	--	--	10	10	ug/L	--
2-Methylphenol	--	--	10	10	ug/L	--
2-Nitroaniline	--	--	25	50	ug/L	--
2-Nitrophenol	--	--	10	10	ug/L	--
3,3-Dichlorobenzidine	--	0.077	10	50	ug/L	FAWQC HH consumption
3-Methylphenol & 4-Methylphenol	--	--	10	10	ug/L	--
3-Nitroaniline	--	--	25	10	ug/L	--
4,6-Dinitro-2-methylphenol	--	765	25	50	ug/L	FAWQC HH consumption
4-Bromophenyl phenyl ether	--	--	10	10	ug/L	--
4-Chloro-3-methylphenol	--	--	10	10	ug/L	--
4-Chlorophenol	268	0.1	NL	NL	ug/L	LA chronic/LA NDWS
4-Chloroaniline	--	--	10	10	ug/L	--
4-Chlorophenyl phenyl ether	--	--	10	10	ug/L	--
4-Methylphenol	--	--	10	10	ug/L	--
4-Nitroaniline	--	--	25	50	ug/L	--
4-Nitrophenol	--	--	25	50	ug/L	--
Acenaphthene	--	2700	10	10	ug/L	FAWQC HH consumption
Acenaphthylene	--	--	10	10	ug/L	--
Aniline	--	--	NL	10	ug/L	--
Anthracene	--	110000	10	10	ug/L	FAWQC HH consumption
Azobenzene	--	--	NL	10	ug/L	--
Benzidine	125	0.00017	NL	100	ug/L	LA freshwater chronic /LA NDWS
Benzo(a)anthracene	--	0.049	10	10	ug/L	FAWQC HH consumption
Benzo(a)pyrene	--	0.049	10	10	ug/L	FAWQC HH consumption
Benzo(b)fluoranthene	--	0.049	10	10	ug/L	FAWQC HH consumption
Benzo(ghi)perylene	--	--	10	10	ug/L	--
Benzo(k)fluoranthene	--	0.049	10	10	ug/L	FAWQC HH consumption
Benzoic acid	--	--	NL	50	ug/L	--
Benzyl alcohol	--	--	NL	10	ug/L	--
bis(2-Chloroethoxy)methane	--	--	10	10	ug/L	--
bis(2-Chloroethyl) ether	--	1.4	10	10	ug/L	FAWQC HH consumption
bis Chloromethyl ether	--	0.00078	NL	NL	ug/L	FAWQC HH consumption
bis(2-Ethylhexyl) phthalate	--	5.9	10	10	ug/L	FAWQC HH consumption
Butyl benzyl phthalate	--	5200	10	10	ug/L	FAWQC HH consumption
Carbazole	--	--	10	10	ug/L	--
Chrysene	--	0.049	10	10	ug/L	FAWQC HH consumption
Dibenz(a,h)anthracene	--	0.049	10	10	ug/L	FAWQC HH consumption
Dibenzofuran	--	--	10	10	ug/L	--
Diethyl phthalate	--	120000	10	10	ug/L	FAWQC HH consumption
Dimethyl phthalate	--	2900000	10	10	ug/L	FAWQC HH consumption
Di-n-butyl phthalate	--	12000	10	10	ug/L	FAWQC HH consumption
Di-n-octyl phthalate	--	--	10	10	ug/L	--
Fluoranthene	--	370	10	10	ug/L	FAWQC HH consumption
Fluorene	--	14000	10	10	ug/L	FAWQC HH consumption
Hexachlorobenzene	--	0.00025	10	10	ug/L	LA NDWS
Hexachlorobutadiene	0.32	0.11	10	10	ug/L	LA chronic/LA NDWS
Hexachlorocyclopentadiene	--	17000	10	50	ug/L	FAWQC HH consumption
Hexachloroethane	--	8.9	10	10	ug/L	FAWQC HH consumption
Indene	--	--	NL	100	ug/L	--
Indeno(1,2,3-cd)pyrene	--	0.049	10	10	ug/L	FAWQC HH consumption
Isophorone	--	2600	10	10	ug/L	FAWQC HH consumption
Naphthalene	--	--	10	10	ug/L	--
Nitrobenzene	--	1900	10	10	ug/L	FAWQC HH consumption
Nitrosamines	--	1.24	NL	NL	ug/L	FAWQC HH consumption
N-Nitrosodimethylamine	--	8.1	NL	10	ug/L	FAWQC HH consumption
N-Nitrosodi-n-propylamine	--	1.4	10	10	ug/L	FAWQC HH consumption
N-Nitrosodiphenylamine	--	16	10	10	ug/L	FAWQC HH consumption
N-Nitrosodibutylamine	--	0.587	NL	10	ug/L	FAWQC HH consumption
N-Nitrosodiethylamine	--	1.24	NL	10	ug/L	FAWQC HH consumption
N-Nitrosopyrrolidine	--	91.9	NL	10	ug/L	FAWQC HH consumption
Pentachlorobenzene	--	4.1	NL	10	ug/L	FAWQC HH consumption
Pentachlorophenol	7.9	8.2	25	50	ug/L	FAWQC/FAWQC HH consumption
Phenanthrene	--	--	10	10	ug/L	--
Phenol (total)	290	50	10	10	ug/L	LA chronic/LA NDWS
Pyrene	--	11000	10	10	ug/L	FAWQC HH consumption
Pyridine	--	--	NL	20	ug/L	--
Tributyltin TBT	0.01	--	NL	NL	ug/L	FAWQC CCC
Malathion	0.1	--	NL	50	ug/L	FAWQC freshwater CCC
Parathion	0.013	--	NL	10	ug/L	FAWQC freshwater CCC

TABLE 5-3 (CONTINUED)
SCREENING LEVELS AND REPORTING LIMITS
BAYOU VERDINE AREA OF CONCERN, CALCASIEU ESTUARY

Chemical	Ecological Surface Water - Salt Water Screening Level	Human Health Secondary Contact/consumption Screening Level	Contract Laboratory Program	SW-846 or EPA Methods	Units	Reference
TCL DIOXINS/FURANS						
2378-TCDD	--	7.20E-10	0.01	0.00001	ug/L	FAWQC HH consumption
2378-TCDF	--	--	0.01	0.00001	ug/L	--
12378-PeCDF	--	--	0.025	0.00001	ug/L	--
12378-PeCDD	--	--	0.025	0.00001	ug/L	--
23478-PeCDF	--	--	0.025	0.00001	ug/L	--
123478-HxCDF	--	--	0.025	0.000025	ug/L	--
123678-HxCDF	--	--	0.025	0.000025	ug/L	--
123478-HxCDD	--	--	0.025	0.000025	ug/L	--
123678-HxCDD	--	--	0.025	0.000025	ug/L	--
123789-HxCDD	--	--	0.025	0.000025	ug/L	--
234678-HxCDF	--	--	0.025	0.000025	ug/L	--
123789-HxCDF	--	--	0.025	0.000025	ug/L	--
1234678-HpCDF	--	--	0.025	0.000025	ug/L	--
1234678-HpCDD	--	--	0.025	0.000025	ug/L	--
1234789-HpCDF	--	--	0.025	0.000025	ug/L	--
OCDD	--	--	0.05	0.00005	ug/L	--
OCDF	--	--	0.05	0.00005	ug/L	--
Total TCDD	--	--	NL	0.00001	ug/L	--
Total TCDF	--	--	NL	0.00001	ug/L	--
Total PeCDD	--	--	NL	0.00001	ug/L	--
Total PeCDF	--	--	NL	0.00001	ug/L	--
Total HxCDD	--	--	NL	0.000025	ug/L	--
Total HxCDF	--	--	NL	0.000025	ug/L	--
Total HpCDD	--	--	NL	0.000025	ug/L	--
Total HpCDF	--	--	NL	0.00005	ug/L	--

CLP Reporting Limits were ascertained from the CLP SOWs.
SW-846 or EPA Method Reporting Limits are from either Quanterra Laboratories or the Methods.
-- screening levels not established in references provided by EPA
NL = Not Listed.
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
ug/L = micograms per liter
CAS = Chemical Abstract Number
DDD = Dichlorodiphenyldichloroethane
DDE = Dichlorodiphenyldichloroethene
DDT = Dichlorodiphenyltrichloroethane
BHC = Benzene hexachloride
MEK = Methyl Ethyl Ketone
MIBK = Methyl Isobutyl Ketone
References:
EPA, Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition, 9/86 and Revisions.
Northeast Analytical, Inc., Guide to Environmental Analytical Methods, Fourth Edition, Genium Publishing Corporation,1998.
EPA, Statement of Work for Organic Analysis, Multi-Media, Multi Concentration, OLM 04.2, 8/94 and Low Concentration OLC 02.1, 2/96.
EPA, Statement of Work for Analysis of PCDDs and PCDFs, Multi-Media, Multi Concentration, DFLM 01.1, 9/91.
EPA, Statement of Work for Inorganics Analysis, Multi-media Multi-concentration, ILM 0.4.0, 3/97.
* Total chromium is assumed to be hexavalent unless total exceeds hexavalent screening value and, then speciation will be done.
Note:
(1) These are estimated quantitation limits (EQLs). EQLs are the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The EQL is generally 5 to 10 times the method detection limit. However, it may be nominally chosen within these guidelines to simplify data reporting. For many analytes, the EQL analyte concentration is selected for the lowest non-zero standard in the calibration curve. Sample EQLs are highly matrix-dependent. The EQLs listed above are provided for guidance and may not always be achievable.
(2) Solid reporting limits are based on wet weight. Normally, data are reported on a dry weight basis; therefore, reporting limits will be higher, based on the percent dry weight in each samples.

APPENDIX A

SYSTEMATIC-RANDOM SAMPLING PROTOCOL

APPENDIX A

SYSTEMATIC-RANDOM SAMPLING PROTOCOL

A.0 INTRODUCTION

The proposed Phase I sampling program was designed to help determine nature and extent of chemical contamination and support risk assessment within the Bayou Verdine AOC of the Calcasieu Estuary. The proposed sampling program considers spatial coverage and sample size sufficiency. Phase II sampling, not discussed herein, will address data gaps, areas with high contaminant concentration variance, hot spot delineation, and ecological gradients.

Phase I sediment and surface water samples analyzed from the Bayou Verdine AOC must be collected in a manner to achieve two data quality objectives (DQOs). First, in order to address nature and extent of contamination, and ultimately remedial alternatives, the locations of samples must be selected to provide adequate coverage of an AOC. Such a plan entails sampling using a systematic basis, hence the name systematic sampling. A purely random strategy would not guarantee adequate coverage of the AOC. A purely systematic plan would not guarantee an unbiased estimate of the population mean. Therefore, the systematic sampling has a random start point. Second, the number of samples to be analyzed should be sufficient that the sample mean and variance of a contaminant of potential concern (COPC) meets a predetermined confidence and precision with respect to the unknown true population mean. Confidence and precision of chemical data collected for prior studies is used to address this second DQO, sample size.

The Bayou Verdine AOC has been divided into an upper Residential Segment and a lower Industrial Segment to consider human health exposure. The two segments will be evaluated separately.

A.1 SAMPLE SIZE DETERMINATIONS

A.1.1 SURFACE SEDIMENT SAMPLE SIZE

Approximately 70 chemicals or chemical groups have been detected in surface sediment samples analyzed during various studies conducted on lower Bayou Verdine (Industrial Segment) since 1992 based on data from the NOAA database (NOAA 1997). Similarly, 35 chemicals or chemical groups have been detected in surface sediment samples on upper Bayou Verdine (Residential Segment). These chemicals and chemical groups are listed in Table A-1 and Table A-2, respectively.

Given a mean and a standard deviation, an iterative set of three equations is used to determine the number of samples required to achieve a prespecified confidence and precision. The equations and their use are given in Section 4.4.3 of Gilbert (1987).

Results of sample size calculations performed on lower Bayou Verdine historical data indicate that 25 samples will achieve a confidence interval (CI) of 70 percent and a relative error (RE) of 30 percent (power = 0.7) for 31 of 70 detected analytes. These analytes are in bold-font in Table A-1. An 80 percent CI and a 20 percent relative error (power = 0.8) are achieved for 15 of 70 chemicals (indicated by bold-font numbers in the 80/20 column of Table A-1). These predictions assume sample variance is constant over time.

Results of sample size calculations performed on upper Bayou Verdine historical data indicate that 25 planned samples will achieve a 70 percent CI and a 30 percent RE for 33 of 35 analytes. These analytes are in bold font in Table A-2. An 80 percent CI and a 20 percent RE are achieved for 14 of 35 analytes (indicated by bold-font numbers in the 80/20 column of Table A-2). These predictions also assume sample variance is constant over time.

A.1.2 SURFACE WATER SAMPLE SIZE

Approximately 26 chemicals or chemical groups have been detected in surface water samples analyzed during various studies conducted on lower Bayou Verdine (Industrial Segment) since 1992 based on data from the CEEAG data base (CEEAG 1996).

Results of sample size calculations performed on these historical surface water data indicate that the nine planned samples will achieve a CI of 70 percent and a relative error of 30 percent (power = 0.7) for 21 of 26 analytes. These analytes are in bold font in Table A-3. Thirteen of 26 analytes achieve a CI of 80 percent and a relative error of 20 percent (indicated by bold-font numbers in the 80/20 column of Table A-3). These predictions assume that sample variance is constant over time.

Results of sample size calculations performed on upper Bayou Verdine (Residential Segment) historical surface water data indicate that the three planned samples will not achieve a 70 percent CI and a 30 percent RE or an 80 percent CI and a 20 percent RE for any previously detected analyte (Table A-3). These predictions also assume that sample variance is constant over time.

Small required sample size results (e.g. two) for analytes having one or just a few detections are suspect. A large number of censored data (non-detects) with the same or similar quantitation limits will reduce the standard deviation (data variation) used in the sample size equation and thereby reduce the number of samples required. In this instance, the sample size calculation performs as if the analyte results are more certain than is actually the case. This circumstance also applies to the surface sediment results.

A.2 SAMPLE LOCATIONS

The surface sediment sample locations were selected by EPA=s FIELDS software as described in Section 3.2. Sample locations are presented in Figure 3-1. The deep sediment sample locations will be biased locations, based on the results of elevated SVOC concentrations in the surface sediment (Section 3.3). The surface water sample locations are systematic, based on an even spacing.

A.3 GLOSSARY

Random - A variable whose observed values may be considered outcomes of a random experiment (e.g. the drawing of a random sample).

Systematic - Relating to or consisting of a system; an organized or established procedure.

Mean - The value obtained by summing all of the variates in a distribution and then dividing by the number of variates in that distribution.

Confidence - The quality or state of being certain. Confidence Interval - Consists of two random boundary points between which we have a certain specified level of confidence that the population parameter lies.

Precision - Refers to the size of an estimator=s variance or, equivalently, the narrowness of a confidence interval for the parameter being estimated. The smaller the variance of the estimator, the higher is the precision of the estimator. Equivalently, since the width of a confidence interval depends on the variance estimate, the narrower is the width of the confidence interval, the higher is the precision of the estimator.

Variance - The degree of dispersion of a random variable x about the mean of x.

Standard Deviation - The square root of the variance; it has the same units as the mean.

A.4 REFERENCES

Calcasieu Estuary Environmental Action Group (CEEAG). 1999. Database of Environmental Media (1980 to 1999) on CD-ROM.

National Oceanic and Atmospheric Administration (NOAA). 1997. Database of Environmental Media (1980 to 1996) on CD-ROM, from Contamination Extent Report and Preliminary Injury Evaluation for the Calcasieu Estuary. June.

Environmental Protection Agency (EPA). 1992. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Draft Addendum to Interim Final Guidance. Office of Solid Waste Permits and State Programs Division.

Gilbert, Richard O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold Company. New York.

TABLE A - 1
LOWER BAYOU VERDINE - NUMBER OF SURFACE SEDIMENT SAMPLES
REQUIRED FOR CONFIDENCE AND PRECISION

Retained for Consideration in the BERA	Analyte*	Number of Detections	Number of Samples Collected	Mean Concentration	Standard Deviation	Units	Number of Samples Required for 70/30**	Number of Samples Required for 80/20***
x	***Acenaphthene***	10	24	3402.819	4405.117	PPB	22	70
x	Acetone	14	23	271.17	535.104	PPB	48	161
x	***Aluminum***	24	24	15446.774	6608.369	PPM	4	***9***
x	***Anthracene***	14	24	5464.56	7614.793	PPB	24	81
x	***Antimony***	1	13	5.777	2.733	PPM	4	***11***
x	***Arsenic***	23	24	4.665	2.335	PPM	4	***12***
x	***Aroclor 1254***	3	18	78.609	108.384	PPB	24	79
x	Aroclor 1260	1	18	58.637	89.558	PPB	29	97
x	Bis(2-ethylhexyl) phthalate	7	24	6156.361	12121.86	PPB	47	161
x	Benz(a)anthracene	22	24	14052.341	34720.74	PPB	74	252
x	Dibenz(a,h)anthracene	14	24	5797.389	13264.714	PPB	64	216
x	Benzo(a)pyrene	21	24	9134.629	21390.193	PPB	67	226
	Barium	24	24	197.698	138.466	PPM	7	***22***
x	Benzo(b)fluoranthene	20	24	10856.858	27109.471	PPB	75	357
	Benzene	8	23	119.757	519.077	PPB	225	773
x	***Beryllium***	22	24	0.887	0.419	PPM	4	***11***
x	Benzo(g,h,i)perylene	10	24	4841.797	8205.629	PPB	35	119
x	Benzo(k)fluoranthene	6	24	3896.357	5958.795	PPB	29	97
x	2-Butanone	12	23	135.168	516.543	PPB	175	601
x	***Cadmium***	12	24	1.931	2.609	PPM	23	76
	Calcium	24	24	23048.593	16724.284	PPM	8	***23***
	Carbazole	1	16	4893.137	6496.08	PPB	22	74
	Chromium (hexavalent)	23	23	124.187	142.553	PPM	17	55
x	Chrysene	22	24	32164.143	87328.527	PPB	89	304
	4-Chloro-3-methylphenol	1	24	4184.462	5957.929	PPB	25	85
x	Chlorobenzene	4	23	122.937	518.802	PPB	214	733
	1,1,2-Trichloroethane	1	23	119.187	519.094	PPB	227	780
x	Hexachlorocyclohexane-beta	1	18	3.184	4.653	PPB	27	89
x	***Hexachlorocyclohexane-delta***	1	18	2.12	1.434	PPB	7	***20***
x	Hexachlorocyclohexane-gamma (Lindane)	1	18	2.445	1.898	PPB	8	26
	Cobalt	18	24	40.052	162.344	PPM	197	676
x	***Copper***	24	24	52.223	38.441	PPM	8	***24***
x	Carbon disulfide	6	23	123.238	518.724	PPB	213	729
x	Dibenzofuran	1	13	3524.34	6729.365	PPB	45	151
x	Di-n-butyl phthalate	2	24	4179.254	5961.663	PPB	25	85
	Ethylbenzene	2	23	122.035	518.971	PPB	217	744
x	Fluoranthene	19	24	8833.164	18009.93	PPB	51	172
x	***Fluorene***	12	24	4653.472	5872.499	PPB	20	67
x	High molecular weight PAHs, total	23	23	99847.876	245031.797	PPB	73	249
x	Indeno(1,2,3-c,d)pyrene	10	24	4691.863	8656.046	PPB	42	141
x	***Iron***	24	24	14584.36	5651.46	PPM	3	**8**
x	***Lead***	24	24	51.507	53.961	PPM	14	46
x	Low molecular weight PAHs, total	22	22	45702.01	85089.28	PPB	42	144
	Magnesium	24	24	4730.127	2679.195	PPM	5	***15***
x	***Manganese***	24	24	244.375	142.363	PPM	5	***15***
x	***Mercury***	9	24	0.278	0.319	PPM	17	56
x	2-Methylnaphthalene	15	24	7928.802	14982.08	PPB	44	148
	Methylene chloride	6	23	122.697	518.859	PPB	214	736
x	Naphthalene	10	24	3730.396	5377.527	PPB	26	87
x	***Nickel***	23	24	27.476	18.768	PPM	7	***21***
x	***N-nitrosodiphenylamine***	2	16	5056.887	6544.063	PPB	21	70
x	PCBs, total	3	18	119.436	187.89	PPB	31	103
	Petroleum hydrocarbons as gasolines	6	6	11208.333	23953.461	PPM	56	189
x	***Petroleum hydrocarbons, total as diesel***	5	6	2465.658	2685.877	PPM	15	50
x	Phenanthrene	22	24	28150.896	55846.845	PPB	48	163
	Potassium	23	24	1552.104	839.533	PPM	5	***13***
x	Pyrene	23	24	30215.183	66758.627	PPB	59	202
x	***Selenium***	11	24	3.734	5.411	PPM	26	88
x	***Silver***	6	13	1.718	1.218	PPM	7	***22***
	Sodium	24	24	5817.769	6382.731	PPM	15	51
	Semivolatile TICs	11	11	204.4	202.893	PPB	13	42
	Tetrachlorethene	5	23	131.812	518.901	PPB	186	638
x	Thallium	5	24	1.426	3.324	PPM	66	224
	Toluene	4	23	122.757	518.827	PPB	214	735
x	BHCs, total	1	18	3.692	6.395	PPB	37	125
x	PAHs, total	23	23	143562.842	322608.447	PPB	61	209
x	***Vanadium***	24	24	30.394	13.965	PPM	4	***10***
	Volatile TICs	8	8	4.436	7.264	PPB	33	111
	Xylenes, total	10	22	146.76	529.617	PPB	156	536
x	***Zinc***	24	24	782.759	988.491	PPM	20	67

* Bold-italics font analytes indicate the number of detects achieve a 70% confidence with 30% relative error assuming 25 samples.
** Indicates the number of samples required to achieve 70% confidence with 30% relative error asssuming varience of the data is not different than that of the historic samples.
*** Indicates the number of samples required to achieve 80% confidence with 20% relative error assuming varience of the data is not different than that of the historic samples.
Bold-italics font numbers indicate detected analytes that achieve 80% confidence with 20% relative error assuming 25 samples.

BERA - Baseline Ecological Risk Assessment
BHCs - Benzene hexachlorides
PAH - Polycyclic aromatic hydrocarbons
PCBs - Polychlorinated biphenyls
PPM - Parts per million
PPB - Parts per billion
TICs - Tentatively Identified Compounds

TABLE A - 2
UPPER BAYOU VERDINE - NUMBER OF SURFACE SEDIMENT SAMPLES
REQUIRED FOR CONFIDENCE AND PRECISION

Retained for Consideration in the BERA	**Analyte***	**Number of Detections**	**Number of Samples Collected**	**Mean Concentration**	**Standard Deviation**	**Units**	**Number of Samples Required for 70/30****	**Number of Samples Required for 80/20*****
x	***Acetone***	1	3	39.333	47.353	PPB	18	61
x	***Aluminum***	3	3	9063.333	2307.647	PPM	2	***4***
x	***Anthracene***	1	3	148.333	140.03	PPB	12	38
x	***Arsenic***	3	3	2.967	2.25	PPM	8	***25***
x	***Benz(a)anthracene***	1	3	141.667	128.485	PPB	11	35
x	***Benzo(a)pyrene***	1	3	171.667	180.439	PPB	14	47
	Barium	3	3	230	112.468	PPM	4	***11***
x	***Benzo(b)fluoranthene***	1	3	208.333	243.943	PPB	17	58
x	***Beryllium***	1	3	0.67	0.547	PPM	9	29
x	***Benzo(g,h,i)perylene***	1	3	168.333	174.666	PPB	14	46
x	***Cadmium***	3	3	1.083	0.653	PPM	6	***16***
	Calcium	3	3	6020	1702.381	PPM	2	***5***
	Chromium (hexavalent)	3	3	79.767	118.024	PPM	27	91
x	***Chrysene***	1	3	361.667	509.518	PPB	25	83
x	***Chlorobenzene***	1	3	6.833	4.252	PPB	6	***17***
	Cobalt	3	3	8.067	8.812	PPM	15	50
x	***Copper***	1	3	20.45	28.571	PPM	24	81
x	***Carbon disulfide***	1	3	6.333	2.93	PPB	4	***10***
x	***Di-n-butyl phthalate***	2	3	171	206.986	PPB	19	62
x	***Fluoranthene***	1	3	175	203.899	PPB	17	57
x	***High molecular weight PAHs, total***	2	2	1272.5	1735.947	PPB	23	78
x	***Indeno(1,2,3-c,d)pyrene***	1	3	145	134.257	PPB	11	37
x	***Iron***	3	3	10780	7803.486	PPM	7	***23***
x	***Lead***	3	3	20	7.99	PPM	3	***8***
	Magnesium	3	3	10116.667	12549.336	PPM	19	65
x	***Manganese***	3	3	447.233	609.175	PPM	23	78
x	***Nickel***	2	3	19.833	17.662	PPM	11	34
x	***Phenanthrene***	1	3	118.333	88.081	PPB	8	***24***
	Potassium	3	3	732.667	509.211	PPM	7	***21***
x	***Pyrene***	1	3	338.333	469.104	PPB	24	81
x	***Selenium***	1	3	0.587	0.618	PPM	14	47
	Sodium	3	3	402.667	412.044	PPM	14	45
	Semivolatile TICs	3	3	13.767	8.965	PPB	6	***19***
x	***PAHs, total***	2	2	1537.5	2110.714	PPB	24	79
x	***Vanadium***	3	3	19.167	9.319	PPM	4	***11***
	Volatile TICs	2	2	0.374	0.433	PPB	17	56
x	Zinc	3	3	455.167	723.165	PPM	31	***5***

* Bold-italics font analytes indicate the number of detects achieve a 70% confidence with 30% relative error assuming 25 samples.
** Indicates the number of samples required to achieve 70% confidence with 30% relative error asssuming varience of the data is not different than that of the historic samples.
*** Indicates the number of samples required to achieve 80% confidence with 20% relative error assuming varience of the data is not different than that of the historic samples.
Bold-italics font numbers indicate detected analytes that achieve 80% confidence with 20% relative error assuming 25 samples.

BERA - Baseline Ecological Risk Assessment
PAH - Polycyclic aromatic hydrocarbons
PCBs - Polychlorinated biphenyls
PPM - Parts per million
PPB - Parts per billion
TICs - Tentatively Identified Compounds

TABLE A - 3
LOWER BAYOU VERDINE - NUMBER OF SURFACE WATER SAMPLES
REQUIRED FOR CONFIDENCE AND PRECISION

Retained for Consideration in the BERA	Analyte*	Number of Detections	Number of Samples Collected	Mean Concentration	Standard Deviation	Units	Number of Samples Required for 70/30**	Number of Samples Required for 80/20***
	1,1,2-Trichloroethane	5	16	4.97	2.13	ug/l	4	***9***
	1,2-Dichloroethane	16	16	32.50	15.11	ug/l	4	10
	Acetone	1	16	5.84	4.40	ug/l	8	25
x	***Aluminum***	7	9	89.22	71.61	ug/l	9	28
	Barium	9	9	150.11	34.10	ug/l	2	***6***
	Bromoform	5	16	4.97	1.16	ug/l	2	***4***
	Calcium	9	9	160222.22	34375.78	ug/l	2	***4***
	Chloride	8	8	5461.25	1690.33	mg/l	2	***6***
	Chlorine, Total	5	7	0.06	0.05	mg/l	8	24
	Chloroform	5	16	4.03	1.37	ug/l	2	***6***
x	***Copper***	2	9	2.73	1.50	ug/l	5	14
x	Total Petroleum Hydrocarbons - Diesel Range	6	8	1.42	1.23	mg/l	10	32
x	***Iron***	8	9	272.21	222.60	ug/l	9	29
x	***Lead***	1	9	1.93	0.89	ug/l	4	10
	Magnesium	9	9	332333.33	107143.60	ug/l	2	***6***
x	***Manganese***	9	9	207.28	102.00	ug/l	4	11
	Methylene Chloride	1	16	4.06	1.48	ug/l	3	***7***
x	Nitrogen, Ammonia	15	15	3.16	3.06	mg/l	12	40
	Potassium	9	9	114033.33	35037.77	ug/l	2	***6***
	Sodium	9	9	2974444.44	1207819.43	ug/l	4	***8***
x	***Sulfate***	8	8	989.88	135.94	mg/l	2	***2***
	Tetrachloroethene	1	16	4.66	0.94	ug/l	2	***4***
x	***Vinyl Chloride***	1	16	4.94	0.25	ug/l	2	***2***
x	Zinc	9	9	111.07	116.29	ug/l	14	46
x	bis(2-Chloroethyl)ether	3	9	6.78	6.91	ug/l	14	44
x	bis(2-Ethylhexyl)phthalate	3	9	22.67	33.99	ug/l	28	94

UPPER BAYOU VERDINE - NUMBER OF SURFACE WATER SAMPLES
REQUIRED FOR CONFIDENCE AND PRECISION

Retained for Consideration in the BERA	Analyte*	Number of Detections	Number of Samples Collected	Mean Concentration	Standard Deviation	Units	Number of Samples Required for 70/30****	Number of Samples Required for 80/20****
	1,1,2-Trichloroethane	1	3	9.00	6.93	ug/l	8	26
	1,2-Dichloroethane	1	3	50.00	77.94	ug/l	30	101
	Chloroform	1	3	3.67	2.31	ug/l	6	18

* Bold-italics font analytes indicate the number of detects achieve a 70% confidence with 30% relative error assuming 9 samples.
** Indicates the number of samples required to achieve 70% confidence with 30% relative error asssuming varience of the data is not different than that of the historic samples.
*** Indicates the number of samples required to achieve 80% confidence with 20% relative error assuming varience of the data is not different than that of the historic samples.
Bold-italics font numbers indicate detected analytes that achieve 80% confidence with 20% relative error assuming 9 samples.
**** No detected analytes in Upper Bayou Verdine achieve confidence and precision assuming 3 samples.

BERA - Baseline Ecological Risk Assessment
mg/L - Milligrams per liter
ug/L - Micrograms per liter

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN FORM CDM FEDERAL PROGRAMS CORPORATION

CDM FPC Health and Safety Program PROJECT DOCUMENT #: 3280-041-PP-HSAP

PROJECT NAME: Remedial Investigation Calcasieu Estuary Cooperative Site **WORK ASSIGNMENT #**: 041 **REGION**: VI

JOBSITE ADDRESS: Bayou Verdine AOC of Calcasieu Estuary is located near city of Lake Charles in Calcasieu Parish, Louisiana

CLIENT: United States Environmental Protection Agency (EPA)

PROJECT: 3280-041

EPA CONTACT: John Meyer, RI/FS RPM

CLIENT CONTACT: John Meyer, RI/FS RPM

PHONE #: (214) 665-6742

PHONE #: (214) 665-6742

OBJECTIVES OF FIELD WORK:

The overall objective of the Remedial Investigation (RI) for the Calcasieu Estuary Cooperative Site (Site) is to: 1) determine the nature and extent of the sediment contamination, 2) evaluate the risks posed to human health and the environment because of the sediment contamination, and 3) determine and evaluate remedial alternatives to mitigate the risk.

TYPE: Check as many as applicable

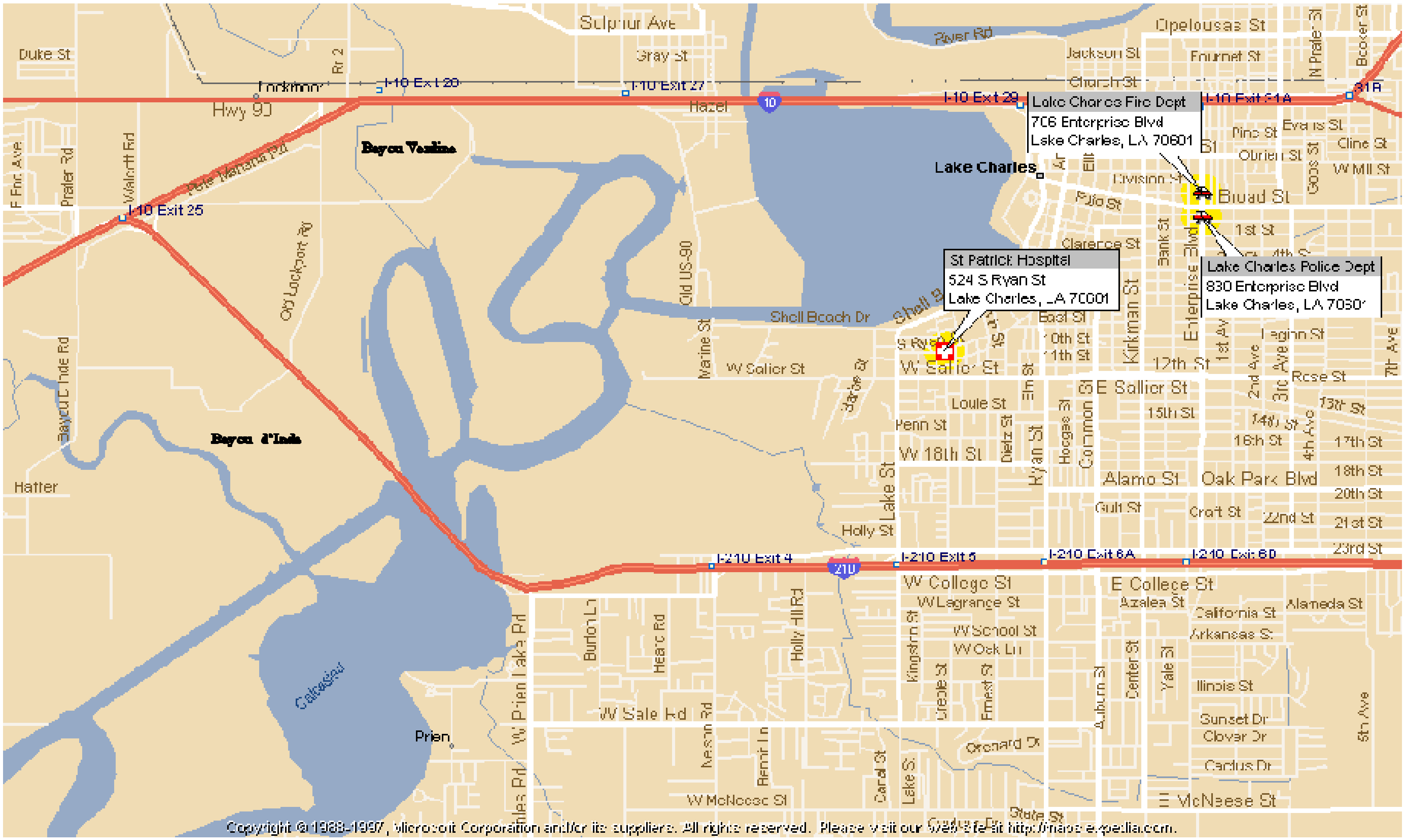
(X) Active	( ) Landfill	( ) Unknown
( ) Inactive	( ) Uncontrolled	( ) Military
( ) Secure	(X) Industrial	(X) Other: Residential Wetland/Estuary
(X) Unsecured	( ) Recovery	
( ) Enclosed Space	( ) Well Field	

DESCRIPTION AND FEATURES:

The Bayou Verdine is located in Calcasieu Parish, Louisiana north to northwest of the city of Lake Charles, and is considered an AOC of the Calcasieu Estuary Site . Bayou Verdine is a wetland that is a major tributary to the estuary. The Bayou's headwaters originate in the farmland areas north of Mossville, Louisiana and flows southeast before entering the Calcasieu River at the northern tip of the Coon Island Loop. Bayou Verdine is approximately three to eight feet deep and has an estimated average rate of flow of approximately eight cubic feet per second in its southern reaches. The area around Bayou Verdine is characterized by mixed residential, commercial, and heavy industrial used. The industrialized areas house several petrochemical and agrochemical plants that manufacture and process products such as petroleum, sodium hydroxide, chlorine, Teflon, butadiene, synthetic rubber, trichloroethylene and perchloroethylene. Industries that have wastewater outfalls permitted under the National Pollutant Discharge Elimination System Facility discharges include: Vista Chemical Company; Conoco, Incorporated; and PPG Industries. Wastewater discharges, storm water runoff, and accidental releases have contaminated the surface water, sediments and marine life in Bayou Verdine.

SURROUNDING POPULATION: (X) Residential (X) Industrial ( ) Rural ( ) Urban (X) Other: Commercial

Site Location Map



HISTORY:

Calcasieu Estuary is an industrialized area where several petrochemical and agrochemical plants manufacture and process a variety of chemicals. These chemical manufacturing and petroleum refining companies first appeared during the early 1920s with the discovery of nearby petroleum and gas reserves. Access to water transportation enabled the industrial base to support more than ten major petroleum refining and chemical operations that produce a wide range of industrial chemicals, petroleum products, and commercial feedstocks. This growth in activities also led to contaminated sediments in the adjacent wetlands and tributaries (Bayou d'Inde, and Bayou Verdine). Environmental studies of the Calcasieu Estuary date back to the early 1970's and have involved sediment, surface water, aquatic biota, and industry effluent investigations. The majority of contamination in Bayou Verdine appears associated with historical discharges from three facilities: Vista Chemical Company; Conoco, Incorporated; and PPG Industries. .

WASTE TYPES: (X) Liquid (X) Solid ( ) Sludge ( ) Gas ( ) Unknown (X) Other (Specify): Sediment

WASTE CHARACTERISTICS: Check as many applicable.

( ) Corrosive	( ) Flammable	( ) Radioactive
(X) Toxic	(X) Volatile	( ) Reactive
( ) Inert Gas	( ) Unknown	( ) Other:

WORK ZONES:

Work zones will be used during sediment and surface water sampling. Zones will consist of physical perimeter of the floating sampling platform. Additional physical boundaries (warning tape, railings , buoys) will be used if deemed necessary. Shore line will be used as the support zone

HAZARDS OF CONCERN:

( ) Heat Stress attach guidelines	(X) Noise
(X) Cold Stress attach guidelines	(X) Inorganic Chemicals
( ) Explosive/Flammable	( ) Organic Chemicals
( ) Oxygen Deficient	(X) Motorized traffic
( ) Radiological	(X) Heavy Machinery
(X) Biological: Alligators, Snakes, Insects, Ticks,	(X) Slips, Trips, & Falls
Poisonous Plants	(X) Other: Drowning

PRINCIPLE DISPOSAL METHODS AND PRACTICES:

Waste produced at the facilities along Bayou Verdine were historically discharged through wastewater outfalls permitted under the National Pollutant Discharge Elimination System . Investigation Derived Waste will be stored in proper containers at the Site trailer.

HAZARDOUS MATERIAL SUMMARY: *Circle waste type*

CHEMICALS: Amount/Units:	SOLIDS: Amounts/Units:	SLUDGES: Amounts/Units:	SOLVENTS: Amounts/Units:	OILS: Amounts/Units:	OTHER: Amounts/Units:
Acids Pickling Liquors	Flyash Asbestos	Paint Pigments	Halogenated (chloro, bromo) Solvents	Oily Wastes Gasoline	Laboratory Pharmaceutical
Caustics	Milling/Mine Tailings	Metal Sludges	Petroleum Hydrocarbons	Diesel Oil	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Alcohols	Lubricants	Radiological
Dyes/Inks	Non-ferrous Smelter	Aluminum	Ketones	PCBs	Municipal
Cyanides	***Metals***	Distillation Bottoms	Esters	Polynuclear Aromatics	Construction
Phenols	Other: ***Fe, Mn, Ni, Cd, Zn, Pb, Cu, Ag, Cr***	Other:	Other:	Other:	Munitions
Halogens					Other:
Dioxins					
Other:					

OVERALL HAZARD EVALUATION: ( ) High ( ) Medium (X) Low ( ) Unknown (Where tasks have different hazards, evaluate each. Attach additional sheets if necessary.)

JUSTIFICATION: CDM Federal personnel will stay out of the way of heavy equipment and seaworthy vehicles and should remain cognizant of their surroundings at all times.

FIRE/EXPLOSION POTENTIAL: ( ) High ( ) Medium (X) Low ( ) Unknown

BACKGROUND REVIEW: (X) Complete ( ) Incomplete Additional information to be collected during RI.

KNOWN CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION (specify units and media)	IDLH PEL/TLV ppm or mg/m^3 (aerosol)	IDLH ppm or mg/m^3 (aerosol)	WARNING CONCENTRATION ppm	SYMPTOMS/EFFECTS OF ACUTE EXPOSURE	PHOTOIONIZATION POTENTIAL
Antimony	6 mg/kg (SD)	0.5 mg/m^3	50 mg/m^3 (as Sb)		Irritant to eyes skin and nose, unable to smell properly, headache, nausea, vomiting and diarrhea	NA
Arsenic	10 mg/kg (SD)	0.5 mg/m^3 (as Org. As)	5 mg/m^3 (as As)		Ulceration of nasal septum, Gastrointestinal disturbances, peripheral neuropathy, respiratory irritant	NA
PCB (Aroclor 1254)	380 mg/kg (SD)	0.5 mg/m^3 (Skin)	5mg/m^3		Respiratory irritation, liver damage, irritated eyes, potential occupational carcinogen, mutagenic	NA
Cadmium	10.83 mg/kg (SD)	0.005 mg/m^3 (as Cd)	9 mg/m^3 (as Cd)		Pulmonary edema, breathing difficulties, tight chest, headache, nausea, vomiting and diarrhea	
Chromium	186 mg/kg (SD)	0.5 mg/m^3 (as Cr)	250 mg/m^3 (as Cr)		Irritated eyes, skin and lungs; fibrosis (histologic)	
Copper	150 mg/kg (SD)	1 mg/m^3 (as Cu)	100 mg/m^3 (as Cu)		Irritant to eyes, skin ,nose and pharynx	
γ- Hexachlorocyclo-hexane (Lindane)	7.7 mg/kg (SD)	0.5 mg/m^3 (Skin)	50mg/m^3		Irritant to eyes, skin and nose. breathing difficulties, convulsions, headache, nausea	
Lead	216.58 mg/kg (SD)	0.05 mg/m^3	100 mg/m^3		Fatigue, pallor, abdominal pain, insomnia	NA
Manganese	1150 mg/kg (SD)	5 mg/m^3	500 mg/m^3 (as Mn)		Insomnia, mental confusion, dry throat, cough, chest tight, fever, lower-back pain, vomiting, fatigue	
Mercury	1.1 mg/kg (SD)	0.1 mg/m^3 (Skin)	10 mg/m^3 (as Hg)		Irritant to eyes and skin; coughing, chest pain, breathing difficulties, insomnia, headache, fatigue	
Naphthalene	19 mg/kg (SD)	50 mg/m^3	250 ppm		Irritant to eyes, headache, nausea, vomiting, renal shutdown	
Nickel	68.42 mg/kg (SD)	1 mg/m^3	10 mg/m^3 (as Ni)		sensitization dermatitis, pneumonitis	
Silver	4.17 mg/kg (SD)	0.01 mg/m^3	10 mg/m^3 (as Ag)		Blue-grey eyes, Gastrointestinal disturbances	

NA = Not Available NE = None Established U = Unknown OFF = Off-site D = Drums L = Lagoon
S = Soil SW = Surface Water T = Tailings W = Waste TK = Tanks SD = Sediment
A = Air GW = Groundwater SL = Sludge

FIELD ACTIVITIES COVERED UNDER THIS PLAN:

Task Description/Specific Technique-Standard Operating Procedures/Site Location (attach additional sheets as necessary)	TYPE	PRIMARY	CONTINGENCY	HAZARD SCHEDULE
1 Surface water and sediment sampling.	***Intrusive***	***D Modified***	***C Exit Area***	***Low***
2	***Intrusive***	***D Modified***	***C Exit Area***	***Low***
3	***Intrusive***	***D Modified***	***C Exit Area***	***Low***
4	***Intrusive***	***D Modified***	***C Exit Area***	***Low***

*PERSONNEL AND RESPONSIBILITIES (Include subcontractors)

NAME	FIRM/REGION	CDM FPC HEALTH CLEARANCE	RESPONSIBILITIES	ON SITE?
Mitch Goldberg	CDM Federal/Golden	Yes	Project Manager	***1 - 2 - 3 - 4 -5 - 6***
Clint Werden	CDM Federal/Golden	Yes	Task Manager/Site Health and Safety Coordinator	***1 - 2 - 3 - 4 - 5 - 6***
Krista Lippoldt, Robbert-Paul Smit, Clint Werden, Steve Fundingsland Cherie Zakowski, Angela Paterson	CDM Federal Golden and Lenexa	Yes	Field Scientist, Geologists and Engineers	***1*** - ***2***

Protective Equipment: *Specify by task. Indicate type and/or materials, as necessary. Use copies of this sheet if necessary.*

BLOCK A: TASKS: ***1*** (X) PRIMARY
LEVEL: ***D* - *MODIFIED*** ( ) CONTINGENCY

Respiratory: (X) Not Needed
( ) SCBA, Airline: ______
( ) APR: ______
( ) Cartridge: ______
( ) Escape Mask: ______
( ) Other: ______

Head and Eye: ( ) Not Needed
(X) Safety Glasses: ______
( ) Face Shield: ______
( ) Goggles: ______
(X) Hard Hat: ______
( ) Other: ______

Boots: ( ) Not Needed
(X) Boots: Leather steel-toed work boots
( ) Overboots: Rubber, as needed

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit: ______
( ) Splash Suit: ______
( ) Apron: ______
( ) Tyvek: ______
( ) Saranex: ______
(X) Coverall: Cloth or street clothes
( ) Other: ______

Gloves: ( ) Not Needed
( ) Undergloves: ______
(X) Gloves: Nitrile or Latex
( ) Overgloves: ______

( ) Other: Specify Below

BLOCK B: TASKS: ***1*** ( ) PRIMARY
LEVEL: ***C*** (X) CONTINGENCY

Respiratory: ( ) Not Needed
( ) SCBA, Airline: ______
(X) APR: Full Face
(X) Cartridge: GCM-H
( ) Escape Mask: ______
( ) Other: ______

Head and Eye: ( ) Not Needed
(X) Safety Glasses: ______
( ) Face Shield: ______
( ) Goggles: ______
(X) Hard Hat: ______
( ) Other: ______

Boots: ( ) Not Needed
(X) Boots: Leather steel-toed work boots
( ) Overboots: ______

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit: ______
( ) Splash Suit: ______
( ) Apron: ______
(X) Tyvek: ______
( ) Saranex: ______
( ) Coverall: ______
( ) Other: ______

Gloves: ( ) Not Needed
( ) Undergloves: ______
(X) Gloves: Nitrile or Latex
( ) Overgloves: ______

( ) Other: Specify Below

BLOCK C: TASKS: 1 - 2 - 3 - 4 - 5 - 6 ( ) PRIMARY
LEVEL: A - B - C - D - MODIFIED ( ) CONTINGENCY

Respiratory: ( ) Not Needed
( ) SCBA, Airline: ______
( ) APR: ______
( ) Cartridge: ______
( ) Escape Mask: ______
( ) Other: ______

Head and Eye: ( ) Not Needed
( ) Safety Glasses: ______
( ) Face Shield: ______
( ) Goggles: ______
( ) Hard Hat: ______
( ) Other: ______

Boots: ( ) Not Needed
( ) Boots: ______
( ) Overboots: ______

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit: ______
( ) Splash Suit: ______
( ) Apron: ______
( ) Tyvek: ______
( ) Saranex: ______
( ) Coverall: ______
( ) Other: ______

Gloves: ( ) Not Needed
( ) Undergloves: ______
( ) Gloves: ______
( ) Overgloves: ______

( ) Other: Specify Below

BLOCK D: TASKS: 1 - 2 - 3 - 4 - 5 - 6 ( ) PRIMARY
LEVEL: A - B - C - D - MODIFIED ( ) CONTINGENCY

Respiratory: ( ) Not Needed
( ) SCBA, Airline: ______
( ) APR: ______
( ) Cartridge: ______
( ) Escape Mask: ______
( ) Other: ______

Head and Eye: ( ) Not Needed
( ) Safety Glasses: ______
( ) Face Shield: ______
( ) Goggles: ______
( ) Hard Hat: ______
( ) Other: ______

Boots: ( ) Not Needed
( ) Boots: ______
( ) Overboots: ______

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit: ______
( ) Splash Suit: ______
( ) Apron: ______
( ) Tyvek: ______
( ) Saranex: ______
( ) Coverall: ______
( ) Other: ______

Gloves: ( ) Not Needed
( ) Undergloves: ______
( ) Gloves: ______
( ) Overgloves: ______

( ) Other: Specify Below

Monitoring Equipment: *Specify by task. Indicate type as necessary. Attach additional sheets as necessary.*

INSTRUMENT	TASK	ACTION GUIDELINES		COMMENTS *(includes schedules of use)*
Combustible Gas Indicator	1-2-3-4-5-6 (X) Not Needed			Entering tanks, vats, sumps and other confined spaces is strictly forbidden.
Radiation Survey Meter	1-2-3-4-5-6 (X) Not Needed			Radiation is not an expected hazard.
Photoionization Detectors ( ) 11.7 eV (X) 10.2 eV ( ) 9.8 eV ( ) __ eV Type _____	1-2-3-4-5-6 ( ) Not Needed	Specify: Detectable odor	If odor of any kind is detected, cease work, move to fresh air.	If further work is necessary in the area where odors were detected, personnel protection will be evaluated.
Flame Ionization Detector Type _____	1-2-3-4-5-6 (X) Not Needed	Specify: Detectable odor	If odor of any kind is detected, cease work, move to fresh air.	If further work is necessary in the area where odors were detected, personnel protection will be evaluated.
Detector Tubes/ Monitor Type _____ Type _____	1-2-3-4-5-6 (X) Not Needed	Specify:		Toxic gases are not expected to be encountered. Entrance into confined spaces where toxic gases could be concentrated is strictly forbidden.
Respirable Dust Monitor Type Type _____	1-2-3-4-5-6 ( ) Not Needed	Specify:	If team observes visible dust in air while working on or near the site they will cease work.	If dusty conditions persist, site will be abandoned and personnel protection reevaluated. Note, engineering controls (i.e., dust suppression during drilling) will be used to control source.
Other Specify:	1-2-3-4-5-6 (X) Not Needed	Specify:	If team members notices eye or throat irritation, or other symptoms of exposure, they will cease work.	

DECONTAMINATION PROCEDURES:

PERSONALIZED DECONTAMINATION:	SAMPLING EQUIPMENT DECONTAMINATION:	HEAVY EQUIPMENT DECONTAMINATION:
Wash well before hand to mouth contact is employed. A shower will be taken as soon as possible after leaving the field. Workers will remove protective clothing in this order: 1) Remove boot covers, if used 2) Remove gloves 3) Remove safety glasses 4) Remove Tyvek or cloth coverall, if used 5) Remove respirator, if used 6) Remove inner gloves 7) Wash hands/face before eating/drinking ( ) Not Needed	See CDM Federal SOP 4-5. All sampling equipment will be thoroughly decontaminated as follows: 1) Wash and scrub with low phosphate detergent 2) Potable tap water rinse. 3) Rinse with 10 percent nitric acid, ultrapure (1 percent for carbon steel implements). 4) Potable tap water rinse. 5) Thoroughly rinse with deionized, demonstrated analytic-free water. 6) Air dry 7) Wrap in aluminum foil for transport ( ) Not Needed	See CDM Federal SOP 4-5. All heavy equipment and tool parts that contact subsurface sediment are constructed of heavy gauge steel and have no natural or synthetic components that could absorb and retain most soil-borne organic contaminants. Prior to removal from the work site, potential contaminated sediment will be scraped or brushed from the exterior surfaces. The augers, cores and any other large equipment in the exclusion zone will be taken to a decon pad and steam cleaned. ( ) Not Needed
CONTAINMENT AND DISPOSAL METHOD: All disposable PPE will be placed in a suitable drum or container and held for appropriate disposal. ( ) Not Needed	CONTAINMENT AND DISPOSAL METHOD: All derived liquids will be contained and held for appropriate disposal. ( ) Not Needed	CONTAINMENT AND DISPOSAL METHOD: All derived liquids will be contained and held for appropriate disposal. ( ) Not Needed

EMERGENCY CONTACTS:	
Water Supply	N/A
Site Telephone	N/A
EPA Release Report #:	1-800-424-8802
CDM 24-Hour Emergency:	1-800-SKY-PAGE (31821#)
Facility Management:	N/A
Other (specify):	
CHEMTREC Emergency:	1-800-424-9300

EMERGENCY CONTACTS:	**NAME**:	**PHONE**:
Health and Safety Manager	Chuck Myers	(703) 968-0900
Project Manager	Ken Black	(303) 232-0131
Site Safety Coordinator	Clint Werden	(303) 232-0131
EPA Contact	John Meyer	(214) 665-6742
Client Contact	John Meyer	(214) 665-6742
Environmental Agency		(800) 234-5677
State Spill Number		
Fire Department-Lake Charles		(318) 491-1360
Police Department-Lake Charles		(318) 491-1311
Sheriff's Department-Calcasieu		(318) 419-3600
State Police		(318) 491-2850
Health Department		(318) 478-6020
Poison Control Center		(800) 764-7661
Occupational Physical	Edward Barnes	1-800-229-3674

CONTINGENCY PLANS: Summarize below.

Evacuate site if any unexpected hazardous conditions are encountered. If staff observe hazards for which they have not been prepared, they will withdraw from the area and call CDM Federal Health and Safety. Without regard to monitoring instrument reading, CDM Federal will leave the site and upgrade their level of protection if they experience nausea or dizziness. No volatile compounds are expected to be encountered at concentrations dangerous to human health. If any odors are noted, work will cease and personnel protection reevaluated. In the event of medical emergency, contact Hospital, Police or Sheriff's Department. If respirable dust is noted, additional engineering controls will be implemented. If these controls do not eliminate the exposure, personnel protection will be reevaluated.

HEALTH AND SAFETY PLAN APPROVALS:

Prepared by: ______________________ Date: ______________

SHSC Signature: ______________________ Date: ______________

HSM Signature: ______________________ Date: ______________

MEDICAL EMERGENCY:

Hospital: St Patrick Hospital (318) 436-2511

Hospital Address: 524 S Ryan St, Lake Charles, LA 70601

Name of Contact at Hospital:

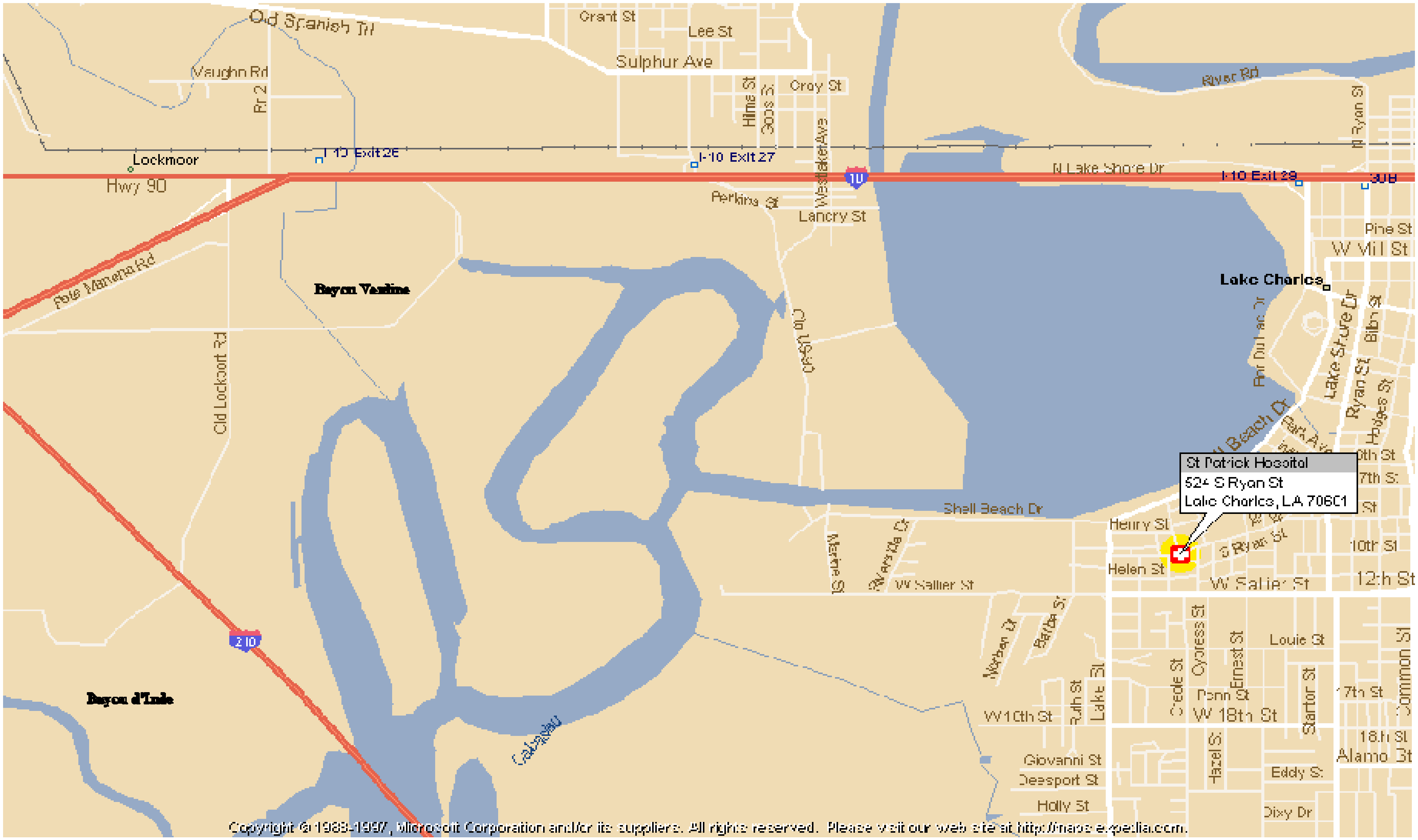
Name of 24-Hour Ambulance: Call 911

Route to Hospital: See attached map (page 11 of 12)

From the upper reaches of Bayou Verdine, go east on I-10 and exit south (right) onto Ryan St. Go approx 1.23 miles to S. Ryan St. Turn Right on S. Ryan St, the hospital is approx 1100 yds down S. Ryan St.

From the lower reaches of Bayou Verdine, get near Old US-90, go east on Shell Beach Dr to Lake St. Turn south (right) onto Lake St, go approx 225 yds and then turn east (left) onto S Ryan St. The hospital is approx 450 yds east of the intersection of Lake St and S Ryan St.

From the Site trailer, take I-210 east, take exit number 6A towards Ryan St. Turn left onto Ryan St., go approx 1.3 miles to S. Ryan St. Turn left on S. Ryan St, the hospital is approx 1100 yds down S. Ryan St.


St Patrick Hospital
524 S Ryan St
Lake Charles, LA 70601
Lake Charles
Bayou Verdine
Bayou d'Inde
Old Spanish Trl
Vaughn Rd
Lockmoor
Hwy 90
I-10 Exit 26
I-10 Exit 27
I-10 Exit 29
Sulphur Ave
Grant St
Lee St
Old Lockport Rd
Perkins St
Lancry St
Westlake Ave
Shell Beach Dr
N Lake Shore Dr
River Rd
Pine St
W Mill St
Lake Shore Dr
Ryan St
Henry St
Helen St
W Sallier St
W 18th St
Louie St
Ernest St
Cypress St
Giovanni St
Holly St
Eddy St
Dixy Dr
Alamo St
12th St
10th St
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BASIC VESSELS OPERATING AND SAFETY PROCEDURES

BASIC OPERATING PROCEDURES

Know and abide by the rules of the road

Always operate vessel so as not to endanger others, Excercise courtesy and common sense

Know the vessel's stopping distance, turning radius, and optimal cruising speed

Always be cognizant of the vessel's position relative to other vessel's

To anchor, bring the bow into the current and put engine in neutral. Lower anchor or spudbar over the bow. The anchor line should be 5 to 7 times the depth of water. **Do not anchor by the stern!!**

Practice the "One-Third Rule" by using 1/3 of the fuel going out, 1/3 to get back and 1/3 in reserve

BASIC NAVIGATION RULES

Meeting Head-On : In this situation the rules require that both vessels should exchange one short blast, give way and pass with sufficient room on each other's port

Crossing Situations : In this situation the rules specify that the vessel which has the other on its starboard side must keep out of the way. It must alter its course to starboard.

Overtaking Situations: The overtaking vessel must keep clear of the vessel it is overtaking.

Bow - Forward part of a boat

Port - The left side of a boat when looking forward

Stern - Back part of a boat

Starboard - The right side of a boat when looking forward

Leeward - The direction away from the wind

Windward - Toward the wind blowing direction

SAFETY PROCEDURES

Every passenger on board must wear an approved Personal Floatation Device (PFD)

Keep the load in the vessel secured, evenly distributed, and low. **Do Not Overload !!**

Passengers should be seated while the vessel is under way. **Bow Riding is Dangerous !!**

Vessel must travel at a "Safe Speed" when operating under conditions of reduced visibility

When fueling: shot off engine; extinguish all smoking materials; close all hatches and ports; fill portable tanks on the dock, **not in the boat**; wipe any spilled gasoline; check for explosive vapors and air out vessel before starting the engine.

Test your PFD.

Check the weather forecasts before leaving shore. Remain watchful for signs of bad weather.

Do not stand or swim behind boat while engine is running.

Tell a co-worker your intended float plan.

BOATER CHECK LIST

PFD's	( )	Tool Kit	( )
Sound Producing Devices	( )	Paddles/Oars	( )
Navigation Lights and Shapes	( )	Extra Clothing	( )
Fire Extinguishers	( )	First Aid Kit	( )
Visual Distress Signals	( )	Flashlight	( )
Anchor and Anchor Lines	( )	Boat Hook	( )
Dewatering Device	( )	Waterproof bag	( )
Overall Vessel Condition	( )	Phone/Radio	( )
Fuel System Condition	( )	Float Plan	( )
Registration/Documentation	( )		

The following personnel have read and fully understand the contents of this Health and Safety Plan and further agree to all requirements contained herein.

Name	Affiliation	Date	Signature

APPENDIX C

STANDARD OPERATING PROCEDURES

CDM Federal's Standard Operating Procedures (SOPs) are not provided electronically. The SOPs are available in hard copy from EPA Region 6 Administrative Record.

APPENDIX D

TECHNICAL DOCUMENTATION FOR FIELD SAMPLING EQUIPMENT

Contingency field equipment specifications and data sheets are not provided electronically. These materials are available in hard copy from EPA Region 6 Administrative Record.

APPENDIX E

FIELD FORMS

CDM Federal's field forms are not provided electronically. These forms are available in hard copy from EPA Region 6 Administrative Record.

APPENDIX F

CONTRACT LABORATORY PROGRAM PROTOCOLS

EPA Region 6 Contract Laboratory Program (CLP) protocols are not provided electronically. These protocols are available in hard copy from EPA Region 6 Administrative Record.